Digital monitoring by whole body photography and sequential digital dermoscopy detects thinner melanomas

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ABSTRACT

INTRODUCTION: Population screening for melanoma remains controversial. There are no studies demonstrating that population screening increases survival. As prognosis of melanoma is directly related to Breslow thickness, a surrogate marker of survival is thickness of melanoma. The development of several self-referred, whole-body photography and sequential digital dermoscopy imaging services reflects the public's concern regarding melanoma.

AIM: To assess the ability of one of these services to detect melanoma at an early, thin stage.

METHODS: Demographic and histological details from 100 melanomas diagnosed through self-referred whole-body photography and sequential digital dermoscopy imaging service compared to those diagnosed through traditional methods from data held by the New Zealand Cancer Registry.

RESULTS: There were 52 invasive and 48 in-situ melanomas: 90% superficial spreading type, 6% lentigo-maligna type and 4% nodular on histology. Forty-eight were diagnosed on first visit; the remainder by serial digital dermoscopy. Thirty-five percent of patients reported having had previous primary melanoma. In 60%, patients had been concerned by the lesion, the rest (40%) detected solely by screening. Patients diagnosed by whole-body photography and sequential digital dermoscopy screening had thinner melanomas compared to the Registry data: 69% <0.75 mm Breslow thickness compared to 52% (p=0.0216); only 1.9% thicker than 3 mm compared to 10.8% (p=0.067).

DISCUSSION: Melanomas detected by self-referred, whole-body photography with sequential digital dermoscopy service are thinner than melanomas detected by traditional diagnostic methods. It remains to be determined whether earlier diagnosis results in improved survival.

KEYWORDS: Dermoscopy; mass screening; diagnosis, melanoma; telemedicine; teledermatology

Introduction

Even though survival from melanoma is strongly associated with depth of invasion, there is no agreement as to the role of screening for melanoma. Neither the Cancer Society of New Zealand,[1] nor the Cancer Council Australia,[2] currently recommend routine skin screening for average risk individuals. This is similar to the advice of the US Preventive Services Taskforce,[3] and is largely based on the absence of studies, rather than studies which show no benefit. Unfortunately it is unlikely that any such screening studies will ever be performed (personal communication, Prof. Mark Elwood, Melanoma Summit 2008, Wellington, New Zealand). Despite this, there is increasing evidence that melanomas detected during a screening examination are thinner than melanomas not so detected.[4–5] In addition, there is general consensus that screening is appropriate in those at high risk of developing melanoma.[6]

Digital dermoscopy, particularly if coupled with sequential imaging, has been demonstrated to be of value in hospital-based clinics.[7] However,

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should screening for melanoma ever be recommended, it will need to be performed in primary care. Several self-referred whole-body photography and sequential digital dermoscopy imaging services have been developed and are being used by the public, yet there is little published evidence that they can effectively detect melanoma at an early stage in the primary care setting.

This descriptive study looks at the thickness of melanomas diagnosed using a whole body photography and sequential digital dermoscopy system available in New Zealand (NZ) and compares them to those detected by traditional means, as reported to the New Zealand Cancer Registry (NZCR).[8]

Methods

A number of proprietary whole-body photography and sequential digital dermoscopy screening systems for melanoma have been developed, including MoleMap NZ. The MoleMap database was queried for patients who had histologically confirmed melanoma, or melanoma-in-situ, diagnosed following whole-body photography and sequential digital dermoscopy. Demographic and histological details were obtained and compared to similar data of melanoma patients detected by standard methods as reported to the NZCR during a 10-year period.[8]

Patients undergoing whole-body photography and sequential digital dermoscopy are largely self-referred, although an increasing number (approximately a third) are being performed at the recommendation of a general practitioner and/or specialist (personal communication, Mr Blair Stewart, MoleMap NZ). Each proprietary system is different; for MoleMap, a standardised history is obtained at each visit by a trained 'melanographer', usually an experienced nurse, and includes demographic data and individual risk factors for melanoma.

Panoramic views of the body are first taken to map the location of the suspect skin cancer(s), followed by macroscopic views (30 mm field of view, 'macro') and then dermoscopic views (15 mm field of view, 'micro') of the lesion(s) (Figure 1).

For the lesions described in this study, a Nikon D50 Digital SLR camera was used for the panoramic images and a Hewlett Packard Photosmart 912 or Canon Photoshot G6 1/1.8 inch 7 megapixel CCD digital camera was used to obtain macro/micro images. A dermoscopic lighting unit with macro adapter was used for the dermoscopic images. Images were stored with 1600 x 1200 pixel resolution on Joint Photographic Experts Group (JPEG) format file with 24-bit colour depth. Proprietary software (MoleMap Point of Diagnosis software) was used to manage these files via a remote server, allowing the diagnosing dermatologist(s) to analyse the data in any location using an authorised computer (Teledermatology).

WHAT GAP THIS FILLS

What we already know: Thickness (Breslow) is the major determinant of survival in malignant melanoma, even for thin melanomas (<1 mm Breslow thickness). There is ongoing debate as to the value of screening for melanoma in New Zealand. A number of self-referred, whole-body photography and sequential digital dermoscopy imaging services are now available, although there have been no studies to demonstrate that they are capable of diagnosing melanoma at an early stage.

What this study adds: Whole-body photography and sequential dermoscopy detect melanomas that are thinner than those found through traditional diagnostic methods.

Figure 1. Image of screen showing sequential dermoscopic images of a suspect pigmented lesion on the back of a patient.

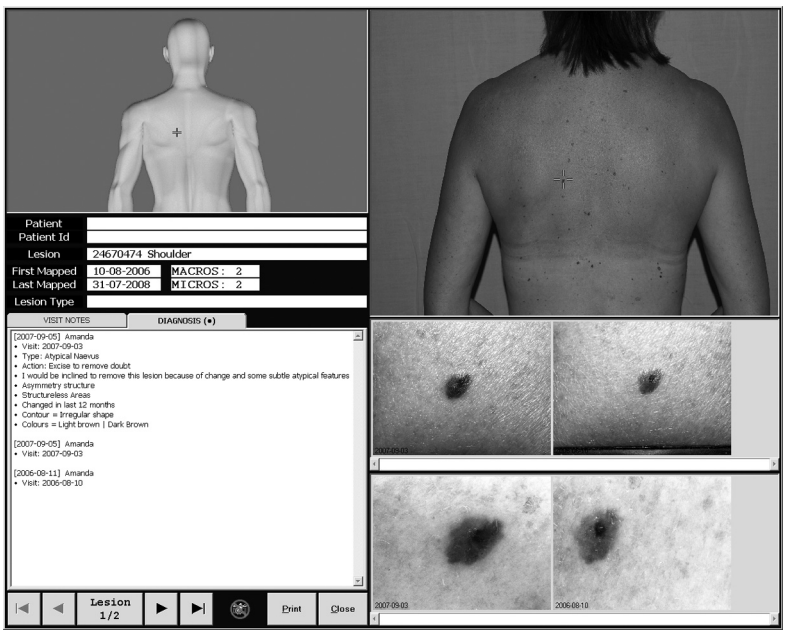

Table 1. Age distribution of patients

Age (years)	Digital dermoscopic screening n (%)	NZCR registrations n (%)
>20	2 (2)	121 (0.8)
20–29	5 (5)	700 (4.4)
30–39	17 (17)	1555 (9.8)
40–49	23 (23)	2615 (16.5)
50–59	29 (29%)	3011 (19.0)
60–69	18 (18%)	3049 (19.2)
>70	6 (6%)	4788 (30.2)
***Mean age**	**51 years**	**59 years**

* chi-square test, df 6, $p<0.001$

Following the visit, one of five dermatologists reviewed the images and data, assessed each lesion, and made appropriate recommendations (Figure 1). The dermatologists generally used pattern recognition for assessing pigmented lesions.[9] Lesions that were suspicious of being a melanoma (graded as likely, probable or possible) were recommended for excision. Lesions where clinical doubt occurred (most often atypical naevi), were recommended for excision, re-imaging in three months or for self-monitoring by the patient. Patients and their doctors were asked to forward copies of all histological examinations of any lesions excised.

The NZCR is a population-based register of all primary malignant diseases diagnosed in NZ, excluding squamous cell and basal cell skin cancers. The tumours are classified using the WHO International Statistical Classification of Diseases and Related Health Problems (ICD), and the WHO International Classification of Diseases for Oncology (ICD-O). All data is mapped forward to ICD-10. Pathology laboratories are the primary source of cancer data to the NZCR, as they are required by law to report any new diagnosis of cancer in NZ, excluding squamous and basal cell skin cancers.

During the period 2005–2007, more than 27 000 individuals enrolled in the MoleMap programme. There were 98 diagnoses of 'excise, likely melanoma', 413 of 'excise, possible melanoma', and 1397 of 'excise, to remove doubt'. Histology reports were available for only 655 of these patients of which 167 confirmed melanoma. The first 100 of these histologically confirmed melanomas were analysed. Statistical analysis was with student *t*-test and chi-square with Yates' correction.

Results

Of the 100 confirmed melanomas, 52 were invasive and 48 were in-situ; 90% were superficial spreading type, 6% were lentigo-maligna type and 4% were nodular on histology. Forty-eight were diagnosed at the first photographic screening and the rest by serial digital imaging. Thirty-five percent of patients reported having had a previous primary melanoma. Sixty percent of the lesions eventually diagnosed as a melanoma had been a concern to the patient, the rest were detected solely by screening.

There was no significant difference in gender between patients diagnosed by self-referred photographic screening and those on the NZCR. Self-referred were, however, slightly younger (age 51 versus 59 years, chi–square test $p< 0.001$) (Table 1).

Table 2. Location of melanoma

	Digital dermoscopic screening		NZCR registrations	
	Female	Male	Female	Male
	n (%)	n (%)	n (%)	n (%)
***Head/neck**	3 (6)	5 (11)	1355 (16)	1953 (22)
Trunk	15 (28)	25 (53)	1675 (19)	3783 (43)
Arm (including shoulder)	13 (25)	10 (21)	2122 (24)	1657 (19)
Legs	22 (42)	7 (15)	3562 (41)	1335 (15)
TOTAL	**53 (100)**	**47 (100)**	**8714 (100)**	**8728 (100)**

* $p=0.008$

In men, melanomas were found most often on the trunk, and in women on the leg, for both self-referred photographic screening and NZCR (Table 2). However, only 8% of the melanomas detected by digital screening were on the head and neck compared to 19% of NZCR (p=0.008).

Sixty-nine percent of invasive melanomas detected by digital screening had Breslow thickness <0.75 mm compared to 52% of NZCR (p=0.02) (Table 3). Only one invasive melanoma (1.9%) in the self-referred photographic screening group was thicker than 3 mm (11% NZCR) (p=0.067, not significant). The average Breslow thickness in an invasive melanoma diagnosed on the first screening visit was 0.87 mm (range 0.30–3.35 mm) but was 0.67 mm (0.22–1.60 mm) when detected by serial monitoring, although this was not statistically significant (p=0.28).

Table 3. Breslow thickness of melanoma

Thickness (mm)	Digital dermoscopic screening n (%)	NZCR registrations n (%)
*<0.75	36 (69)	8289 (52)
0.76–1.49	11 (21)	3411 (22)
1.5–3.0	4 (8)	2432 (15)
>3.0	1 (2)	1707 (11)
TOTAL	52 (100)	15 839 (100)

* p=0.02

Discussion

This study shows that melanomas detected by a self-referred, whole-body photography and sequential digital dermoscopy service are thinner than traditional diagnostic methods, as determined by the NZCR. These results are similar to a number of screening studies. For example, over 90% of melanomas detected clinically during the American Academy of Dermatology national screening programme were in situ or less than 1.5 mm in thickness. This was significantly more than that found in their population-based register,[4–5] and this was without widespread use of digital dermoscopy.

Clinical Practice Guidelines in Australia and New Zealand for the Management of Melanoma published in 2008 do not support screening for melanoma of the general population.[6] However, de facto screening occurs in 'at risk' patients by general practitioners, dermatologists and other specialists.[10] In Queensland, a large cross-sectional general practice study found 11% reported having had a whole-body skin screening examination in the previous 12 months, and 20% in the previous three years.[11] How effective this screening is remains unclear.[12] In an Australian study, the specificity of a skin screening examination was reported to be as high as 86%,[13] which compares favourably with other cancer screening programmes such as breast cancer (mammography), colorectal cancer (faecal occult blood test) and prostate cancer (prostate specific antigen), although other studies are not so positive.[12] The positive predictive values (PPV) of skin screening programmes is in the order of 6–20%, with lower values in programmes where participants were self-selected on the basis of perceived skin cancer risk factors and/or the presence of a worrisome skin lesion.[14–16] However, the yield from various skin cancer screening programmes is generally low. Various studies suggest that only a handful of melanomas are detected for every 1000 individuals screened,[6] although this does not take into account the much larger number of non-melanoma skin cancers that are also diagnosed at the same time.

It is often stated that it is the 'worried well' that avail themselves of screening. The risk factors for melanoma in patients using the MoleMap programme have previously been reported.[17] The majority using the service were of European ethnicity (97.1%), 10% had a self-reported history of melanoma and 15% a history of a first-degree family member with melanoma. A quarter (27%) demonstrated significant sun damage. Thirteen percent of patients had in excess of 50 common naevi and 16% had more than five atypical naevi. Other risk factors included light-coloured hair (33%), blue eyes (45%) and a history of sunburn (90%). Ninety-five percent of those using MoleMap were assessed as having at least one risk factor; 71% had at least two risk factors and 32% had at least three risk factors. The risk factors were even more pronounced in a subgroup of patients who had histologically confirmed melanoma.

Although several studies have now shown an increase in the detection of thin melanomas,[18]

there does not appear to have been a consequent decrease in the number of thicker melanomas detected.[6,8,19] Despite this in Australia, there has been an encouraging decrease in mortality rates in both men and women younger than 55 years of age, so perhaps it is just a matter of time before research shows that screening for melanoma is of benefit.[19]

Clearly, the greatest opportunity for increasing survival in melanoma is in the earlier detection of those melanomas that are most likely to metastasize. Our current understanding is that these are more often nodular melanomas, which appear to have a different growth dynamic.[21-22] Several studies now show that patients with thicker melanomas (>2 mm) are less likely to have attended a physician in the previous three years.[23-24] There may therefore be an opportunity to 'capture' these more dangerous melanomas by offering digital screening in primary care, although the research has yet to be performed to demonstrate that earlier detection of these 'thicker, poorer prognosis' melanomas results in improved survival. Part of the problem is in not knowing at what depth (Breslow thickness) a melanoma metastasizes.

This study demonstrates that self-referred, whole-body photography and sequential digital dermoscopy performed in the community does detect early thin melanomas. As survival from melanoma is strongly associated with depth of invasion, such programmes for at-risk individuals may be advantageous. More research is needed to investigate how to encourage patients with possible melanomas to attend for screening earlier, especially older men.

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COMPETING INTERESTS
Dr Rademaker and Dr Oakley have an established academic interest in digital dermoscopy and teledermatology. Waikato Hospital has recently adopted whole-body photography and digital dermoscopy as an alternative to face-to-face screening for melanoma and non-melanoma skin cancer. Both Drs Rademaker and Oakley are contracted to read MoleMaps for MoleMap NZ; they are paid an item of service fee for reporting, but have no financial or other interest in the company.

These data were presented on a poster at the annual meeting of the Australasian College of Dermatologists at Broadbeach, Queensland, Australia in May 2009 (Oakley A, Rademaker M, Stewart B. Thinner melanomas detected by digital monitoring. Aust J Dermatol 2009; 50 (Suppl 1): A34).

References

1. Cancer Society of New Zealand Position Statement on Skin Cancer and Early Detection 2006. http://www.cancernz.org.nz/reducing-your-cancer-risk/sunsmart/early-detection-of-skin-cancer/early-detection-for-health-professionals/ (accessed December 3rd 2009).
2. The Cancer Council Australia. National Cancer Prevention Policy 2007–09. 2007. NSW, The Cancer Council Australia.
3. US Preventive Services Task Force. Screening for skin cancer: recommendations and rationale. Am J Prev Med. 2001;20(3 Suppl):44–6.
4. Koh HK, Norton LA, Geller AC, et al. Evaluation of the American Academy of Dermatology's National Skin Cancer Early Detection and Screening Program. J Am Acad Dermatol. 1996;34:971–8.
5. Geller AC, Zhang Z, Sober AJ, et al. The first 15 years of the American Academy of Dermatology skin cancer screening programs: 1985–1999. J Am Acad Dermatol. 2003;48:34–41.
6. Clinical Practice Guidelines for the Management of Melanoma in Australia and New Zealand. The Cancer Council Australia and Australian Cancer Network, Sydney and New Zealand Guidelines Group, Wellington; 2008. http://www.nzgg.org.nz/guidelines/dsp_guideline_popup.cfm?guidelineCatID=7&guidelineID=141 (accessed on 2/2/2010)
7. Tan E, Yung A, Jameson M, Oakley A, Rademaker M. Successful triage of patients referred to a skin lesion clinic using teledermoscopy (IMAGE IT trial). Br J Dermatol. 2010 Mar 5. [Epub ahead of print]
8. Richardson A, Fletcher L, Sneyd MJ, et al. The incidence and thickness of cutaneous malignant melanoma in New Zealand 1994–2004. NZ Med J. 2008;121;18–26.
9. Malvehy J, Puig S, Argenziano G, Marghoob AA, Soyer HP; International Dermoscopy Society Board members. Dermoscopy report: proposal for standardization. Results of a consensus meeting of the International Dermoscopy Society. J Am Acad Dermatol. 2007;57:84–95.
10. Youl PH, Janda M, Elwood M, et al. Who attends skin cancer clinics within a randomized melanoma screening program? Cancer Detect Prev. 2006;30:44–51.
11. Janda M, Elwood M, Ring IT, et al. Prevalence of skin screening by general practitioners in regional Queensland. Med J Aust. 2004;180:10–5.
12. Fritschi L, Dye SA, Katris P. Validity of melanoma diagnosis in a community-based screening program. Am J Epidemiol. 2006;164:385–90.
13. Aitken JF, Janda M, Elwood M, et al. Clinical outcomes from skin screening clinics within a community-based melanoma screening program. J Am Acad Dermatol. 2006;54:105–14.
14. Jonna BP, Delfino RJ, Newman WG, Tope WD. Positive predictive value for presumptive diagnoses of skin cancer and compliance with follow-up among patients attending a community screening program. Prev Med. 1998;27(4):611–6.
15. de Rooij MJ, Rampen FH, Schouten LJ, Neumann HA. Skin cancer screening focusing on melanoma yields more selective attendance. Arch Dermatol. 1995;131:422–5.
16. de Rooij MJ, Rampen FH, Schouten LJ, Neumann HA. Volunteer melanoma screenings. Follow-up, compliance, and outcome. Dermatol Surg. 1997;23:197–201.
17. Oakley A, Rademaker M, Stewart B. High risk patients self select for melanoma screening. Australas J Dermatol. 2009;50 (Suppl 1), A34.
18. McPherson M, Elwood M, English DR, et al. Presentation and detection of invasive melanoma in a high-risk population. J Am Acad Dermatol. 2006;54:783–92.
19. Warycha MA, Christos PJ, Mazumdar M, et al. Changes in the presentation of nodular and superficial spreading melanomas over 35 years. Cancer. 2008;113:3341–8.
20. Baade P, Coory M. Trends in melanoma mortality in Australia: 1950–2002 and their implications for melanoma control. Aust N Z J Public Health. 2005;29:383–6.
21. Haass NK, Smalley KS. Melanoma biomarkers: current status and utility in diagnosis, prognosis, and response to therapy. Mol Diagn Ther. 2009;13:283–96.
22. Tejera-Vaquerizo A, Barrera-Vigo MV, López-Navarro N, Herrera-Ceballos E. Growth rate as a prognostic factor in localized invasive cutaneous melanoma. J Eur Acad Dermatol Venereol. 2009 Jul 13.(epub)
23. Swetter SM, Johnson TM, Miller DR, et al. Melanoma in middle-aged and older men: a multi-institutional survey study of factors related to tumor thickness. Arch Dermatol. 2009;145:397–404.
24. Geller AC, Elwood M, Swetter SM, et al. Factors related to the presentation of thin and thick nodular melanoma from a population-based cancer registry in Queensland Australia. Cancer. 2009;115:1318–27.