ORIGINAL RESEARCH

COMPARISON OF DIAGNOSTIC ACCURACY OF SKIN LESIONS BY GENERAL PRACTITIONERS AND SPECIALISTS

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ABSTRACT

Background: Skin cancer is an increasing problem in fair-skinned populations world-wide. In north Queensland the majority of skin cancer is managed initially by general practitioners (GPs). It is important that doctors are able to diagnose skin lesions accurately. There are limited studies comparing the diagnostic accuracy of GPs and specialists. The objective of this report is to compare diagnostic agreement based on histopathology between GPs and specialists. Methods: All excised and histologically confirmed skin cancers in Townsville/Thuringowa, Australia were recorded between December 1996 and October 1999. Clinical diagnoses were recorded and compared to histological diagnoses. Positive predictive values (PPVs) and sensitivities were calculated for the clinical diagnoses and stratified by histological subtype. The results were then compared between the GPs and specialists. Results: A total of 193 doctors – 174 GPs and 19 specialists - were recorded in the database. Only one of the 19 specialists was a dermatologist. Of the 8,694 first excisions, 1443 lesions (16.6%) were treated by specialists, the rest by GPs. For basal cell carcinoma, positive predictive value was significantly higher for specialists compared to GPs (81.2% versus 70.6%, $p<0.001$). For squamous cell carcinoma, common naevi and seborrhoeic keratosis sensitivity was significantly higher for GPs than for specialists (42.2% versus 34.6%; $p=0.005$, 42.9% versus 30.5% $p=0.036$ and12.9% versus 4.3% $p=0.018$, respectively). Conclusions: In the present analysis, although specialists had higher accuracy in the diagnosis of basal cell carcinomas, GPs were more accurate in the diagnosis of squamous cell carcinoma, common naevi and seborrhoic keratosis. Overall there was little difference in the diagnostic performance between the two groups of doctors. These findings contrast with previous studies which have found the diagnostic performance of specialists to be superior to that of GPs. It is possible that this improved diagnostic performance may be a reflection of the higher caseload of skin cancer experienced by GPs in North Queensland

Key Words: Basal cell carcinoma; Cutaneous melanoma; Diagnostic accuracy; Actinic keratosis; Skin cancer; Squamous cell carcinoma; Histology; Histopathology; General practitioner; specialist.

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INTRODUCTION

Skin cancer is an increasing problem in fair-skinned populations world-wide (Buettner and Raasch 1998; Lens and Dawes 2004; Diepgen and Mahler 2002). Age-standardised incidence rates per 100,000 for cutaneous melanoma (CM) were 40.5, 13.3 and 6.1 for men, and 31.8, 9.4 and 7.7 for women in Australia, the US and the UK respectively (Lens and Dawes 2004). Basal cell carcinoma (BCC) and squamous cell carcinoma (SCC) are the most common cancers in all three countries (Diepgen and Mahler 2002). Australia has the world's highest recorded incidence of all types of skin cancer, (Lens and Dawes 2004) (Diepgen and Mahler 2002; Staples et al. 2006) with incidence rates being even higher in tropical north Queensland (Buettner and Raasch 1998).

BCC and SCC are by far the most common cancers in Australia with an incidence more than four times that of all other registered cancers combined (Askew, Glasziou, and Del Mar 2001). CM is the fifth most common cancer in Australia, with the estimated risk of developing melanoma before 75 years of age being one in 26 for Australian men and one in 36 for Australian women (Askew, Glasziou, and Del Mar 2001).

In Australia the majority of suspicious skin lesions are managed initially by general practitioners (GPs)(Askew et al. 2007). Thus as the proportion of all skin cancers excised by GPs is increasing (Askew et al. 2007) it is important that Australian GPs diagnose skin cancer correctly. In the UK there is some controversy about the ability of general practitioners to recognise skin cancer and prioritise referrals (Thomson, Loffeld, and Marsden 2005; McKenna et al. 2004) and there is a debate about the appropriateness of CM, BCC and SCC being managed in a primary care setting (McKenna et al. 2004; Thomson, Loffeld, and Marsden 2005). A recent large Australian study compared the diagnostic performance of mainstream GPs with that of primary care skin cancer doctors in regard to excised and biopsied skin lesions. Both groups were found to diagnose skin cancers with an overall high sensitivity (Youl, Baade et

al. 2007).

However there are very few published studies internationally which have directly compared the performance of GPs and specialists in the diagnosis of skin cancer. Most of these studies have compared GPs with dermatologists, with only two studies identified which compared the performance of GPs with plastic surgeons as well as dermatologists,(Jackson, Morgan, and Ellison 2000; Murchie et al. 2008) and only one study which has directly compared the diagnostic performance of GPs and other hospital specialists (Murchie et al. 2008). Many studies have either focused on pigmented skin lesions,(Jackson, Morgan, and Ellison 2000; Chen et al. 2001) or have looked more broadly at dermatological conditions of which skin cancer has formed a subgroup (Morrison, O'Loughlin, and Powell 2001; Tran et al. 2005). Some studies have compared the diagnostic accuracy between the two groups by using photographs of lesions rather than real clinical situations. All studies using this method have shown the diagnostic performance of dermatologists to be superior to general practitioners (Federman, Concato, and Kirsner 1999; Chen et al. 2006; Gerbert et al. 1996; McGee et al. 1994). However, this method seems artificial and might have introduced bias in favour of dermatologists with more training in the use of photographs. These studies have also been limited by small sample sizes.

Interestingly, a systematic review of 32 studies which recorded the diagnostic accuracy of specialists (including, dermatologists, plastic surgeons, oncologists, and general surgeons) and GPs in the diagnosis of melanoma concluded that there was inadequate evidence to suggest significant difference between the two groups (Chen et al. 2001). This report describes the performance of GPs and a mixed group of specialists in correctly diagnosing excised skin cancers. The data were derived from a large registry style incidence study where close to all skin excisions were recorded over a three year period in a regional centre in north Queensland, Australia. The study pre-dated the emergence of designated skin cancer clinics in north Queensland.

MATERIALS AND METHODS

Between the end of 1996 and October 1999, all excised and histologically confirmed skin cancers in Townsville/Thuringowa, north Queensland, Australia (latitude 19.16ºS; population approximately 130,000) were recorded. During the study, pathology reports on all excised skin cancers were collected from the three local pathology laboratories, which routinely collected reports on BCC and SCC to send to the Queensland Cancer Registry. These laboratories served the pathology requests from all hospitals, GPs and specialists in Townsville (a total of 202 GPs and 42 specialists). The data collected on excised skin cancers is likely to be almost complete, as doctors in Townsville routinely seek histology for all excised skin lesions. As Townsville's location is relatively isolated it can be assumed that almost all skin cancers were treated locally. Multiple skin cancers per patient can be identified within the database. Only the first excision per patient with a particular clinical diagnosis was included in our statistical analysis; this was to reduce possible bias resulting from doctors 'learning' the clinical diagnosis from patients presenting for repeated excisions of the same histological type or from clinical information provided by referring doctors. Lesions that had already been diagnosed by excision biopsy prior to referral to specialists were excluded. Further methodological details have been previously published (Buettner and Raasch 1998). Ethics clearance was obtained from James Cook University Human Ethics Committee.

Statistical analysis

Positive predictive values (PPVs) and sensitivities together with exact 95%-confidence intervals (95%-CI) were calculated for the histological diagnoses of basal cell carcinoma (BCC), squamous cell carcinoma (SCC), intra-epithelial carcinoma (IEC), actinic keratosis (AK), cutaneous melanoma (CM), CM in situ, common naevus (CN), atypical naevus (AN), keratoacanthoma and seborrhoeic keratosis. We included missing clinical diagnosis in our calculation of sensitivities as we felt that this more accurately represented real clinical practice. This means that lesions which had a missing diagnosis are included in our calculations as incorrect diagnosis, thereby reducing the correct diagnosis rate.

RESULTS

Between December 1996 and October 1999 a total of 8,694 patients (mean age 58.6 years; 55.2% male) with up to 72 excisions per patient were recorded. Further detailed descriptions of the patients and the incidence of skin cancer were previously published (Buettner and Raasch 1998).

A total of 193 doctors – 174 GPs and 19 specialists - were recorded in the database as sending at least one skin specimen during the study period. The group of specialists comprised one dermatologist, seven general surgeons, one plastic surgeon, four ophthalmologists, three ENT surgeons, one facio-maxillary surgeon and two vascular surgeons.

Of the 8,694 first excisions, 1443 lesions (16.6%) were treated by specialists, the rest by GPs. Of the 8,694 first excisions, 23.5% did not have a clinical diagnosis. GPs were more likely to give a clinical diagnosis (77.4%) than specialists (71.6%; $p<0.001$). For BCC, PPV was significantly higher for specialists compared to GPs (81.2% versus 70.6%, $p<0.001$) (Table 1). For SCC, CN and seborrhoeic keratosis sensitivity was significantly higher for GPs than for specialists (42.2% versus 34.6%; $p=0.005$, 42.9% versus 30.5% $p=0.036$ and12.9% versus 4.3% $p=0.018$, respectively) (Table 1).

Table 1: Comparisons between general practitioners (GPs) and specialists diagnosis: Positive predictive values and sensitivities based on 8,694 skin excisions.

	Positive Predictive Value			Sensitivity (including missing clinical diagnosis)		
	GP	Specialist	p-value	GP	Specialist	p-value
Basal Cell Carcinoma	70.6%	81.2%	P<0.001	64.4%	61.7%	P=0.100
Squamous Cell Carcinoma	49.5%	48.8%	P=0.814	42.2%	34.6%	P=0.005
Intra Epithelial Cancer	45.6%	40.7%	P=0.647	5.2%	4.2%	P=0.541
Actinic Keratosis	29.3%	41.7%	P=0.053	10.0%	7.5%	P=0.188
Seborrhoic Keratosis	54.5%	30.0%	P=0.189	12.9%	4.3%	P=0.018
Keratoacanthoma	36.9%	37.5%	P=0.956	23.8%	15.4%	P=0.171
Cutaneous Melanoma	33.7%	32.5%	P=0.894	30.9%	44.8%	P=0.159
Cutaneous Melanoma in situ	9.1%	36.4%	P=0.311	7.1%	36.4%	P=0.133
Atypical naevus	6.9%	0%	P=1.0	13.3%	0%	P=0.526
Common Naevus	48.6%	51.5%	P=0.751	42.9%	30.5%	P=0.036

DISCUSSION

In the present analysis of a large and unselected sample of skin excisions, although specialists had higher accuracy in the diagnosis of BCCs, GPs actually were more accurate in the diagnosis of SCC, CN and seborrhoic keratoses. Overall there was little difference in the diagnostic performance between the two groups of doctors.

We identified four previous studies in which the methodology allowed comparison of results to our own. A retrospective review of GP referrals to dermatology outpatients, in New South Wales, Australia, compared 151 recorded clinical diagnoses with histological diagnoses. The cases included general skin conditions. For BCC (n=44) a correct clinical diagnosis had been made in 36% of cases by GPs and in 95% by dermatologists (Chen et al., 2006). Numbers were insufficient for meaningful comparison of other types of skin cancer. Similar methods were used in a review of recorded case notes comparing histological diagnoses to clinical diagnoses in a dermatology outpatient setting in Ireland (Morrison, O'Loughlin, and Powell 2001). Of 264 histologically proven skin cancers correct clinical diagnosis was made in only 22% of cases by family practitioners and in 87% of cases by dermatologists. An audit of all malignant melanoma confirmed histologically in a hospital in the UK found that, of 157 melanoma diagnosed, correct clinical diagnosis was made in 9% of GP cases and in 35% of hospital specialist cases (Jackson, Morgan, and Ellison 2000). However in another study, 45.5% of GP cases, and 38% of hospital specialist cases, the lesions had been regarded as a suspicious pigmented lesion. This study concluded that although the diagnostic skill of GPs may be lower, the more important issue is the ability to know when to refer and biopsy, and GPs had demonstrated this ability (Jackson et al., 2000). A further study analysed 1087 pathology reports from excised BCCs in Aberdeen, UK (Murchie et al. 2008). GPs performed significantly less well than dermatologists and plastic surgeons when diagnosing and excising BCCs, but appeared equal in diagnostic skill to other hospital specialists: a correct diagnosis was made in 67.1% , 82.7%, 83.3% and 63.9% of cases for GPs, dermatologists, plastic surgeons, and other hospital specialists, respectively (Murchie et al. 2008).

The strengths of our study were a large sample size of lesions and data from all doctors who excised skin cancers in the regional population resulting in close to complete epidemiological data over a three-year period This implies reduced selection bias, probably resulting in a representative sample of skin lesions and doctors. This was therefore likely to be a representative sample of skin cancers removed by doctors in routine clinical practice.

We did not subdivide our results into dermatologists, plastic surgeons and other hospital specialists. This was for two reasons. First, as there was only one dermatologist and one plastic surgeon in the group, the sample size would be very small and generalisability limited. Second, because of these limited numbers the specialists involved would be easy to identify and confidentiality could not be assured. We are therefore unable to comment on the diagnostic performance of these subgroups of specialists and we do not know if dermatologists performed better than other hospital specialists, as they have in previous studies (Murchie et al. 2008). Although a diverse group of specialists was involved in this study, this is likely to represent the mix of doctors managing skin cancer in regional and rural centres in Australia (Askew 2007).

There are some limitations to the analysis, interpretation and generalisation of the present data which must be acknowledged. First, diagnostic accuracy may have been altered by the failure to record a clinical diagnosis at excision on the pathology request. The lesions which had missing diagnoses were included in our calculations as incorrect diagnoses.The true sensitivity would probably be higher if these missing clinical diagnoses had been available. However we feel that our results should equate to normal clinical practice because the data were obtained from completed histology request forms as part of a registry style study, rather than being specifically requested for the purposes of the study.

Second, there were no pre-determined categories for clinical diagnosis, and different clinicians may categorise their

clinical diagnosis in different ways. For example some clinicians may use the term SCC to incorporate IEC, or may write 'changing naevus' rather than 'atypical naevus'. Third, there are limitations to the use of the terms PPV and sensitivity in this setting as we have no information about the lesions that doctors decided not to excise. As PPV is dependent on prevalence, this measure is likely to be elevated in a specialist setting where the prevalence of more serious lesions is higher due to secondary referral.

Townsville has an extremely high incidence of skin cancer, (Buettner and Raasch 1998) and it is therefore likely that Townsville doctors experience a much higher caseload than practitioners at higher latitudes (further from the equator) in Australia, the UK and elsewhere. Previous studies have shown that higher caseloads and number of years of experience correlate with an improved diagnostic performance for the diagnosis of melanoma (Ek et al. 2005; Morton and Mackie 1998; Youl, Raasch et al. 2007). Hence, generalisability of the present data might be limited.

Although our study shows a superior diagnostic performance by GPs than in previous studies, we feel that the results must be viewed with some caution. While GPs work in a primary care situation, specialists mostly see referred patients, although we do not know what proportion of these lesions in this study were referred. It is likely that specialist practice would have a higher prevalence of skin cancer compared with the mix of skin cancer and benign look alike lesions GPs see,(Buettner and Raasch 1998) resulting in better diagnostic accuracy for skin cancer. This is one reason why one would expect differences in the positive predictive value of a clinical diagnosis between GPs and specialists (Chen et al. 2001).

Conclusion

There is value in identifying whether diagnosis and practice are different between specialist and GP populations when both provide services for the care of skin cancer as they do in Australia and in other countries. In general the cost of specialist services is higher (Del Mar 2000). If the accuracy of diagnosis is similar then identifying the reasons for referral to surgeons may help to define whether referral is appropriate and so in turn help to reduce the cost of care (Raasch 1999).

Our study showed that, although specialists had higher accuracy in the diagnosis of BCCs, GPs were more accurate in the diagnosis of SCC, CN and seborrhoic keratosis. Overall there was little difference in the diagnostic performance between specialists and GPs. These findings contrast with previous studies which have found the diagnostic performance of specialists to be significantly better than GPs. It is possible that this improved diagnostic performance may be a reflection of the higher caseload of skin cancer experienced by GPs in North Queensland (Buettner and Raasch 1998).

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