

Teledermatology in a Rural Family Practice

O'Mahony, D

MB, BCh, DCH, DTM&H, DPH,
Dip Mid COG (SA), FRCGP
Family Practitioner, Bridge
Street, Port St Johns

Banach, L

MD, PhD, MIAC
Associate Professor,
Department of Pathology, and
Director, Telemedicine Unit,
Faculty of Medicine and Health
Sciences,
University of Transkei, Umtata

Mahapa, DH

MB, BCh, M. MED. DERM, AMP
(Manchester)
Acting Head
Department of Dermatology,
Medical University of South
Africa, Pretoria

Lancaster, EW

MD, PhD, MIAC
Department of Pathology,
Medical University of South
Africa, Pretoria

Van der Linde, GD

MB, BCh
Department of Pathology,
Medical University of South
Africa, Pretoria

Williams, BH

DVM, DACVP
Department of Telemedicine
Armed Forces Institute of
Pathology, Washington DC, USA

Herring, RF

Department of Telemedicine
Armed Forces Institute of
Pathology, Washington DC, USA

Asvadi, SA

MD, Chief of Dermatology
Lemuel Shattuck Hospital,
Boston MA, USA

Address for correspondence:

D O'Mahony
P O Box 27, Port St Johns,
South Africa 5120
047-5641225
omahonyd@cybertrade.co.za

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Abstract
BACKGROUND:

Telemedicine can provide specialist services at a distance to rural areas where access to such services is limited, especially in developing countries. The objectives of this study are to describe and evaluate a teledermatology service in a rural family practice.

METHODS:

Internet-based store-and-forward technology was used. Patients were selected who needed a specialist dermatologist's opinion for diagnosis and management. Pictures of skin conditions were taken with a digital camera and forwarded, together with clinical data, via electronic mail (e-mail) to specialist dermatologists at either of three distant academic centres. Digital pictures of skin biopsies were also forwarded from the regional pathology laboratory. Results were received via e-mail.

RESULTS:

Over a twenty-one month period, fifty-two patients had teledermatology consultations. Picture quality was adequate for evaluation in all cases. The family practitioner's provisional diagnosis, compared to the teledermatologists, was correct in 28 (57%) of 49 cases where a definite diagnosis was made. Six patients needed referral to a dermatology clinic. The most common diagnoses (number) were tinea (8), acquired immune-deficiency syndrome associated papulopuritic eruption (3), photosensitive dermatitis (3) scleroderma or morphea (3), pityriasis rosea (2), psoriasis (2) and systemic lupus erythematosus (2).

CONCLUSION:

Most patients with dermatology problems in rural family practice can be managed by means of store-and-forward teledermatology.

Introduction

Dermatology constitutes an important part of family practice. In South Africa, about 14% of consultations with family practitioners include skin conditions.¹ This compares with 15% in the United Kingdom.² However, family practitioners have insufficient training in dermatology³ and as compared to specialist dermatologists, their diagnosis and management of skin disease are significantly poorer.⁴ While patients in urban practice have ready access to specialists, in rural practice access is limited by distance, inconvenience of travelling and cost. In developing countries, access is further constrained by the absolute

shortage of specialists, inefficient transport systems and lack of money, such that neither the state nor patients can afford transport to referral centres. Telemedicine can provide specialist health care, at a distance, for rural communities by means of electronic transfer of medical information. Teledermatology has been used successfully in rural practice in the US and Marshall Islands⁵ and in the UK.⁶

In the rural Port St Johns district, the population numbers about 75 000, the majority of which lives below the poverty line. Primary health care is provided mainly by nurses at state funded clinics, supported by general

practitioners in the public and private sectors. In the last decade, the number of doctors in the district has varied between two and six. The referral hospital at Umtata is 100 Km distant but since 1998, has no specialist dermatologist. Hence, family practitioners have to diagnose and treat practically all dermatology problems. To improve access for patients to dermatological care and to improve family practitioner clinical skills, a teledermatology project was initiated in April 1999.

Methods

Patients who presented at a solo family practice in Port St Johns from April 1999 to December 2000 with dermatological conditions were enrolled in the project if the family practitioner could not make a diagnosis or if he wished confirmation of a suspected diagnosis. Store and forward methodology was used. Pictures of the skin were taken with a digital camera and compressed in Joint Photographic Experts Group (JPEG) format. They were forwarded with clinical details via e-mail, on a standard telephone line, for a specialist dermatologist's opinion at either of three distant academic centres, namely, the Medical University of South African (MEDUNSA), Pretoria, the Armed Forces Institute of Pathology (AFIP), Washington, DC, USA and Lemuel Shattuck Hospital (LSH), Boston MA, USA. Skin biopsies were sent to the Department of Pathology, University of Transkei, Umtata and where indicated, digital pictures of the histology were forwarded to the teledermatologists.

The equipment used comprised a Pentium II computer with Windows 95[®] operating system, a 33,6 Kbps modem, an Olympus digital camera C-1400XL with resolution of 1,140,000 pixels, and the software programmes Adobe Photoshop,[®] AOL Press[®] and WinZip[®] (the latter two are available free from the Internet). The camera was chosen as other projects found it provided good

Figure 1: Teledermatology request form

Teledermatology Request

FROM: Dr Don O'Mahony, Port St Johns

omahonyd@cybertrade.co.za

DATE: 12/12/99

NAME: N M

SEX: F

AGE: 53 yrs

HISTORY: Painful ulceration of lower lip since May 1999. She states that she had "pink spots" on her face in May 1999 but these resolved on a course of tablets (? prednisone). No history of bullae. No previous skin disease. No skin lighteners nor medication. T-totaler.

EXAMINATION: Erosion with pink elevation of exposed skin. Skin biopsy done on 09/12/99 and sent to Dr. Banach at Umtata

DIAGNOSIS: ? localized pemphigus.

PICTURES:



The teledermatologist's diagnosis was actinic cheilitis.

resolution at a reasonable price (R Wootton, personal communication). AOL Press is used for designing web pages. WinZip facilitates the compression of computer data and linkage in a single file for transmission on the Internet. Adobe Photoshop was used to make changes in light intensity and contrast such that images for transmission matched what was actually seen. It was also used to label pictures (name, date and body part).

Initially, the text of patients' details was sent as e-mail and the pictures as

an attachment. However, text and pictures easily got separated and misfiled. To group text and pictures together, a standard teledermatology request form (see figure 1.) was created in AOL Press as a web page. This included the patient's demographic details, history, description of the skin disorder, and the results of any tests. A file with the patient's name was created in WinZip, and the web page and pictures were inserted therein. This file was transmitted via the Internet to the specialist dermatologist.

Results

Fifty-two patients had teledermatology consultations. There were 34 females and 18 males. The average age was 33 years with a range from 2 months to 71 years. Twenty-seven consultations were with MEDUNSA, 10 with AFIP and 15 with LSH. The average number of pictures per patient sent to the teledermatologist was 3 (Range 1 – 5) and the average file size was 491 Kilobytes. The diagnoses are listed in Table 1. No definitive diagnosis was made in three cases.

Picture quality.

In all cases, the teledermatologists judged picture quality to be adequate for evaluation.

Comparison of diagnoses made by the family practitioner to diagnoses made by the teledermatologists.

The diagnoses made by the teledermatologists were taken as correct i.e. "the gold standard". Excluding 3 cases where no definitive diagnosis was made, the provisional diagnosis made by the family practitioner was correct in 28 (57%) cases and incorrect in 21 (43%).

Skin biopsies.

Biopsies were taken on 20 (38%) patients before referral. Digital images of six biopsies were sent to the teledermatologists.

Tests requested by teledermatologists.

A first or repeat skin biopsy was requested for 14 patients, of which 2 were to include direct immunofluorescence for immunoglobulin deposits. There were 5 requests for fungal culture, 3 for human immune deficiency virus (HIV) testing, 3 for syphilis serology, 1 for anti-nuclear antibodies and 1 for TB culture.

Time taken to receive results.

The time taken from dispatch of teledermatology requests to receipt of teledermatology reports, and the number of reports, was as follows:

Table 1: Diagnoses made by teledermatologists

Tinea	8
Papulopruritic eruption – AIDS associated	3
Photosensitive dermatitis	3
Scleroderma or Morphea	3
Pityriasis rosea	2
Psoriasis	2
Systemic lupus erythematosus	2
Actinic cheilitis	1
Atopic dermatitis	1
Contact dermatitis	1
Discoid lupus erythematosus	1
Epidermolysis bullosa	1
Erythema multiforme	1
Erythema annulare centrifugum	1
Fibroepithelioma	1
Granuloma annulare	1
Granuloma inguinale	1
Granulomatous lesions (unspecified)	1
Haemangioma	1
Keratosis pilaris	1
Malignant melanoma (probable)	1
Molluscum contagiosum	1
Nummular eczema	1
Ochronosis	1
Peri -oral dermatitis	1
Pitted keratolysis	1
Pityriasis rubra pilaris	1
Pityriasis versicolor	1
Pseudofolliculitis barbae	1
Pyogenic granuloma	1
Seborrhoeic dermatitis	1
Sub-corneal pustular dermatosis	1
Tuberculosis	1

Total = 49

Note: No definitive diagnosis was made in three patients.

0 – 14 days, 23 (44%); 15 – 28 days, 11 (21%); and >28 days, 18 (35%).

Follow-up of patients.

36 (69%) came for their teledermatology reports. After teleconsultation, 6 (12%) patients were judged to require referral to a dermatology clinic.

Discussion

Research in telemedicine can be separated into telemedicine systems and telemedicine services.⁷ The former deals with the technology *per se* (its efficacy) and the latter with the effectiveness in clinical care when employing the technology.

Overall, the technology functioned efficiently. At the family practice site, pictures were downloaded from the digital camera and dispatched via the Internet without a hitch. The teledermatologists at the three distant academic centres judged that the quality of the transmitted pictures was adequate for diagnosis. Thus, the camera and associated software performed well. Camera quality is important and diagnostic accuracy is improved when a camera with better colour resolution is used.⁸ The family practitioner managed to produce adequate pictures without any special photographic training. Various personnel have been used in teledermatology studies i.e. nurses,⁹ family practitioners,¹⁰ and trained medical photographers¹¹ but they all seem to produce pictures of sufficient quality for telediagnosis. This may be because there is usually one good image when several are taken of a patient.¹²

This project supports store-and-forward methodology (SF) as sufficient for teledermatology diagnosis in primary care. SF means that pictures are taken and sent later for a specialist opinion. This is in contrast to video conferencing (VTC) where a video camera is used and the specialist has a 'live' consultation. Compared with VTC, SF is simpler, less expensive

and more time efficient. VTC requires that the patient, family practitioner, specialist and technicians be available contemporaneously. It requires equipment that is more expensive and infrastructure with either a dedicated telephone line or a satellite for information transmission. Digitised Integrated System Digital Network (ISDN) lines are not available in most rural area of South Africa. VTC is more time-consuming, each consultation lasting about 10 to 25 minutes compared with 6 minutes for SF.¹³ SF appears to be as effective as VTC for most teledermatology cases.¹⁴ The resolution and colour of VTC dermatology images are frequently inferior to still digital photography and the ability of the specialist to study good-quality digital images usually outweighs the advantages of immediacy of VTC.¹⁴

The finding that only 6 out of 52 patients who had teleconsultations needed referral to a dermatology clinic indicates that teledermatology care was clinically effective in this project. The remainder could be managed by the family practitioner

Teledermatology diagnosis has been shown to have a high accuracy in clinical care. In VTC studies, the level of agreement between telediagnosis and face-to-face diagnoses has been 67% to 80%.^{15,16} Studies using SF have also demonstrated high levels of agreement.^{11,17} In most studies,^{11,15,16} the clinical diagnosis made by a dermatologist at the face-to-face examination was chosen as the 'gold standard' to which the teledermatology diagnosis was compared. It is assumed that diagnoses made at face-to-face examination are reproducible but dermatologists do differ in their face-to-face diagnoses. One survey showed agreement in only 68% of cases where two dermatologists examined the same patients.¹⁵ Thus, a substantial proportion of the differences between teleconsultations and face-to-face consultations may be due to different interpretations and the

accuracy of telediagnosis thereby under-rated.¹⁵

Even if the accuracy of telediagnosis is inferior to face-to-face diagnosis, teledermatology offers value to family practitioners and their patients in situations where access to specialist services is limited. In this study, the family practitioner's initial diagnosis was only 57% correct. This rate is similar to that of 47% in a UK study⁴ and 50% in a US study¹⁸ and provides support for initiatives such as that of the Royal College of General Practitioners (UK) for improving the dermatology skills of general practitioners.² If family practitioners correctly diagnose on average only 47% of skin conditions referred to specialists,⁴ then a service which offers diagnostic accuracy of between 67% and 80% is a great improvement. Patient satisfaction was not tested in this study but studies to date have found high levels of patient satisfaction with teledermatology.^{10,16,19}

There was a high initial biopsy rate (20 patients) and the teledermatologists requested 14 further biopsies. While most dermatology consultations do not require skin biopsy, the rate in this study suggests that most patients needed a specialist opinion. There was only one possible malignancy in contrast to studies in other communities where tumours accounted for 19% and 34% of diagnoses.^{12, 15} In this study, all patients except three were black and thus had a negligible risk of skin malignancy compared to white patients.

There were delays in obtaining results. Only 65% of results were available at four weeks. Reasons for delay at the South African academic centre included monitor and Internet server malfunction and a shortage of academic staff. Hence, teledermatology assistance was requested from the USA. In contrast to South Africa, US academic centres are far better staffed and funded. After some initial delays with liaison, the service

improved and the last eight results were received within four weeks.

VTC teledermatology in the UK has been shown to be cost-effective when the distance between the primary care site and teledermatologist exceeded 78Km.²⁰ While this project did not address cost effectiveness; the SF technology used is likely to be more cost effective than VTC. Nonetheless, the family practitioner considers that the project improved

his skills and confidence in dermatology, and that the educational value of teledermatology more than offsets the cost of equipment. For the patients who returned for follow-up, it was gratifying for the family practitioner to present a specialist opinion and treatment plan.

A limitation of this study is the small sample of patients and studies with larger patient numbers are needed to confirm the validity of the findings.

In summary, this project demonstrates that store-and-forward teledermatology is feasible and is sufficient for the management of most dermatology problems in rural family practice.

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