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Teledermatology: great potential for use in developing countries

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Teledermatology has great potential for use in developing countries, but with some reservations.

The development of teledermatology services in the UK has, unfortunately, been caught up in too much political debate. The NHS of the 21st century links income for providers of care to cases seen. This means there is little incentive for specialists to embrace the technology available, because its use may reduce clinical activity and income. Teledermatology is also widely promoted as a way to reduce referrals to specialist services, something that feels threatening to dermatology providers of care. This editorial seeks to highlight the advantages and drawbacks of the use of teledermatology in developing countries, where practical implementation issues are much more relevant than political constraints.

Real time video conferencing and 'store and forward' teledermatology are the two types available. The former is expensive and time consuming, requiring health care professionals to co-ordinate the teledermatology consultation at the same time and a strong uninterrupted digital connection (such as Skype). The latter is more straightforward, allowing images to be taken, stored, sent and reviewed by the specialist at a time convenient to the referrer and reviewer. This article considers the use of 'store and forward' dermatology, being the technique that lends itself best to the needs of the developing world.

The process sounds simple, the face-to-face clinical consultation is replaced by a photograph being taken by the referrer, sent electronically and reviewed remotely by a specialist and clinical advice provided to the referrer. The quality and benefit of the teledermatology consultation will be determined by the quality of the image, the accompanying information, and the expertise of the specialist reviewer in tele-diagnosis. There is good evidence for skin lesions that this virtual consultation can be of enormous clinical value and almost match the gold standard face-to-face consultation provided that the clinical images are accompanied by dermatoscopic images. However, for patients with widespread skin conditions this is not necessarily the case because it may be difficult to obtain and transmit the multiple digital images required to provide representative views, particularly where affected skin includes scalp, nails, hair bearing skin, mucosal surfaces and genital skin.

It is, however, issues of image and data storage that may be particularly challenging in developing countries. In developed countries there exist a range of checks and balances around a teledermatology consultation relating to information governance, data protection and consent. All patients are required to provide signed consent to having images taken, that consent accompanies the images. Images are encrypted for transfer and stored on a secure server or deleted immediately.

In summary therefore, the use of teledermatology provides an attractive solution to supporting dermatology services in remote areas, not just to support patient care but as a teaching tool. Whilst most new cameras and smart phones will support this by providing reasonable quality images, issues around data protection and image storage, to preserve the anonymity of patients, may prove challenging.

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Tungiasis page 9. *Photo: Guiseppe Gaido*

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Trained dermatologists are a limited resource, predominantly located in major cities. This leads to difficulty with diagnosis and management of skin disease where patients are unable to seek expert opinion, due to geographical distance or economic issues. Whilst this is a worldwide problem, it is felt most acutely in developing countries. By its visual nature dermatology naturally lends itself to the benefits of telemedicine, i.e. teledermatology, of which there are two formats;

a) **real-time;** a medical practitioner with the patient uses a videolink to a specialist based elsewhere.

b) **store and forward;** information including history and images is sent to the specialist who can review and reply at their own convenience. The obvious benefits of the latter have made it the overwhelming modality employed today. Over the last decade, advances in digital imaging and communication technology, including the internet and availability of mobile (camera) phone coverage, has brought the possibility of effective teledermatology to the whole globe.

In Europe teledermatology has gradually become accepted as part of an integrated dermatology service provision in countries such as the United Kingdom, Spain and the Netherlands to deliver a more timely and cost effective solution to patient demand via a general practitioner gatekeeper, funded by public/state or insurance based systems. Legal concerns have limited its expansion in the USA but it has been of great value to the American military. Specialist societies have become established in several countries to promote its understanding and use, including the British Society of Teledermatology and the Indian Society for Teledermatology.

To date teledermatology, has been delivered on a charitable basis in developing countries, particularly in Africa, where there are very few qualified dermatologists. The African Teledermatology Project, coordinated by Stephen Kaddu based in Graz, Austria, and Carrie Kovaric at the University of Pennsynvania, USA has established links with Uganda, Botswana, Malawi, Swaziland, Burkina Faso and Lesotho giving clinical and educational support to local health workers. Based in the UK, the Swinfen Charitable Trust offers teledermatology advice to many countries in Africa, as well as the Middle East and Asia including Pakistan and Iraq. A real time teaching project running between the UK and Somaliland uses social networking sites. Such projects rely on the commitment and goodwill of interested dermatologists in the developed world.

Whilst it is possible to set up teledermatology by means of any communication network where high quality images can be transmitted (including email and mobile phone), consideration should be given to security of data, image storage and patient consent. In general, most teledermatology uses internet based platforms where patient data can be encrypted and access is password activated.

However, in developing countries where clinical advice is the central issue and mobile networks may be more reliable than internet access, use of modern high resolution camera phone technology may become more important, pending cost. Already there are specific teledermatology applications such as iDermatology Africa for the African Teledermatology Project, available through iTunes.

Teledermatology is best considered as a tool to help in diagnosis, triage and management advice rather than a substitute for a dermatological consultation and examination. As such, patients should always be advised of the limitations including the inability to communicate with the patient directly (for Store and Forward), reliance on the quality of information and images transmitted, and the possibility of limited or even misdiagnosis. Guidance on optimising teledermatology services can be found on websites of the American Telemedicine Association (Quick guides for Store-Forward Teledermatology and Live Interactive Teledermatology) and British Teledermatology Society. Additionally a detailed description of best practice has recently been completed in the UK; 'Quality Standards for Teledermatology using Store and Forward Images'.

Teledermatology in Bangladesh

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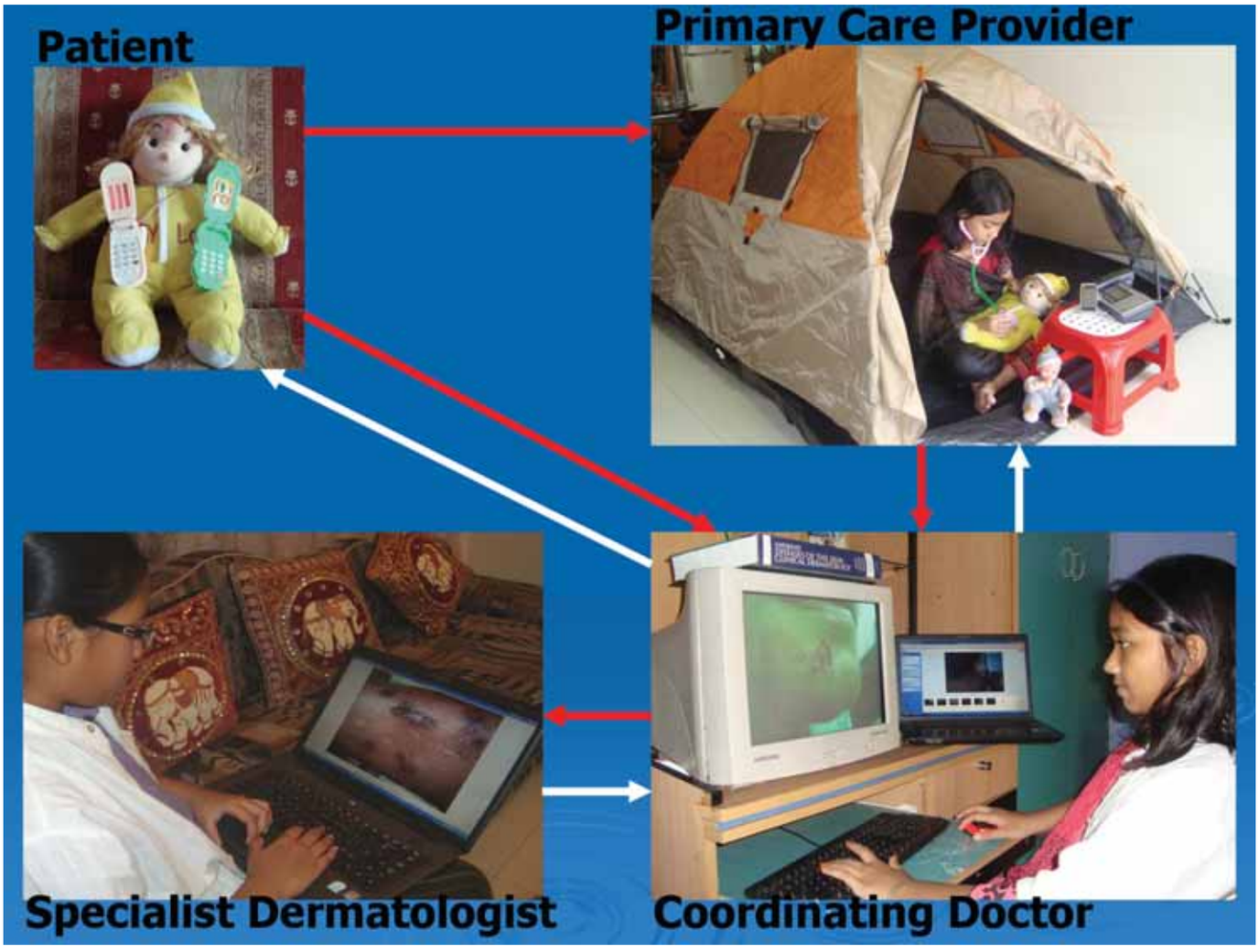

Introduction

Telemedicine, defined as a broad umbrella term for delivery of healthcare facilities at a distance, has reached around the globe, and now healthcare professionals can communicate more quickly, widely, and directly with patients and colleagues, no matter how isolated they are.[1] With the advancement of telecommunication networks and the development of digital imaging technologies, telemedicine is helping to provide patients all over the world with access to healthcare professionals. Telemedicine has indeed produced profound effects on healthcare development in both developed and developing countries.

Among wide range of telemedicine applications, Dermatology is considered to be a specialty that fits well to telemedicine in terms of treatment, diagnosis, advice, research and education. Dermatology is an appropriate entrant for the application of telemedicine techniques for its visual identity and the practicability and dependability of teledermatology is well documented by now.[2] Teledermatology is the delivery of skin care through telemedicine technologies to evaluate clinical images and information, as well as to diagnose, prescribe therapy and advice on health education and referral for patients located at a remote location. Like other telemedicine applications, the goal of teledermatology is to provide high quality of skin healthcare more proficiently by transferring patient information rather than the patient.[3] Teledermatology is turning out to be a well accepted and widespread means of providing skin healthcare facility throughout the world and will obviously play a significant role in the coming future.[4]

Tools for teledermatology

Tools for Teledermatology Practice (TDP) includes: store and forward (SAF), audio-video- conference or real-time consultation (RTC) and hybrid. In the SAF technique, the primary care provider (First Contact) takes still digital images of the skin lesions generated by a digital or mobile camera and disease related information from the patient. These images and information are then transmitted to the service coordinator (Mid Contact)- who carries out quality control checks and then forwards these messages to a consultant dermatologist (End Contact). After receiving a clinical direction from the consultant dermatologist,

the service coordinator returns the message to the referring primary care provider. This type of TDP is considered asynchronous as the images and information are obtained, sent, and assessed at different times and level. Although store-and-forward systems are not expensive and usually provide high levels of accuracy, reliability, and convenience, they lack the immediacy of patient contact with the dermatologist and delay in obtaining the diagnosis and advice on disease management could have some negative impacts.[5] In contrast, real-time consultations (RTCs) are synchronous. Doctors and patients interact in real-time through an audio-visual communication link. But it is not cost effective, though clinical feasibility is well-established. RTCs allow greater clinical information to be obtained from the patient but it is usually more time-consuming.

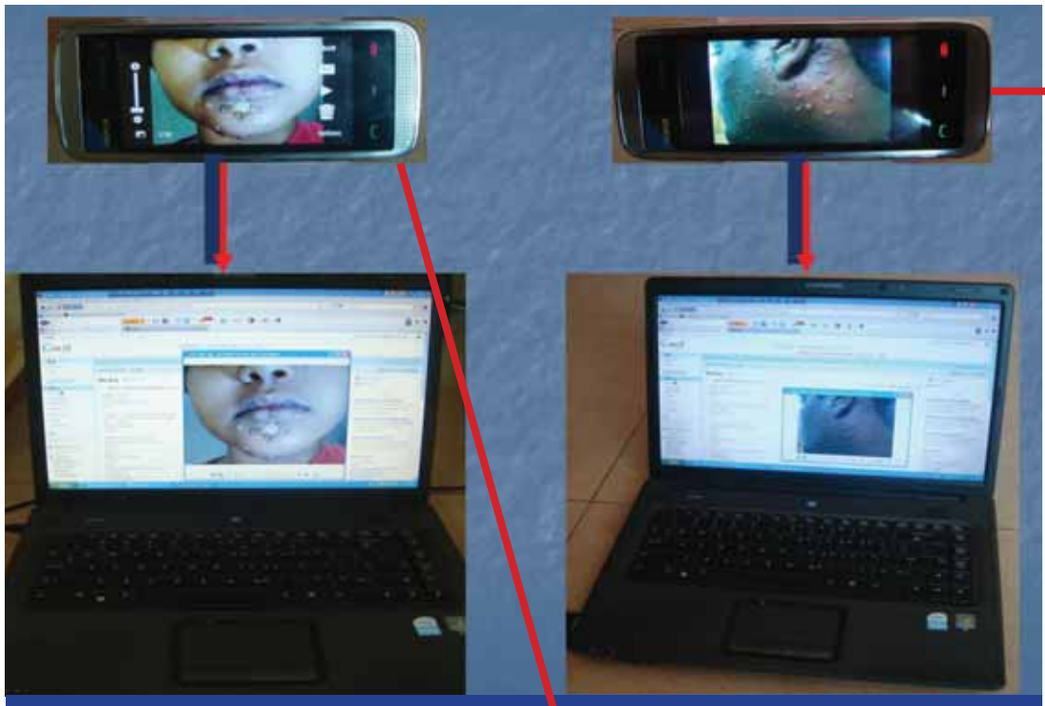

Photo: Pritish Barua

Telemedicine and information communication technology (ICT) in Bangladesh

Although many physicians in Bangladesh have been practicing informal teleconsultation with their colleagues in different countries, more pragmatic approaches were initiated after 1999. Government projects are focused mainly on administrative, data and survey purpose, not addressing direct or indirect doctor-patient interaction. Commercial projects based at private hospitals deal with real time videoconferencing-which is expensive and not directed towards community care. Only a few NGOs are working in the field of true telemedicine for the under-served population of Bangladesh. The success of telemedicine depends on the improvement of information and telecommunication infrastructure. The ICT sector of Bangladesh has changed rapidly within last 3 years. It is one of the fastest growing sectors of its economy. Internet facility is now available in every district of Bangladesh. The number of internet users is still low, but household and business penetration rates are growing dramatically and more people are using internet on a sharing basis. Computer and mobile-based systems are required for access to the internet. Cable and wireless broadband services are available and rapidly growing. But due to slow speed connectivity, lack of Bengali interface and manpower and as well as high cost, computer-based internet access is still not popular. In contrast, mobile-based internet access is huge and increasing day by day. The lower cost of mobile phones and greater mobility had attracted more people to afford and make use of mobile technology. Bangladesh is a model example for rural access to mobile phones. According to BTRC report- the number of mobile subscribers has reached 92.120 million at the end of May 2012 - which is more than half of total population. Mobile phone networks now cover almost all corners of Bangladesh.

Teledermatology: recommendations for Bangladesh

Now we know the concept, spectrum and the benefits of telemedicine, its application in dermatology and different tools for teledermatology practice, we can now put forward a series of recommendations for skin health care management, that would work effectively and efficiently for Bangladesh. Despite our little telemedicine with no teledermatology experience, we have indeed a very good mobile and feasible computer based technology applicable for the teledermatology process.

Although we are lucky in the sense that we have different models of teledermatology in front us from both developed and developing world, our teledermatology will of course differ from them in many aspects. These may include mainly: types of care, status of care providers and disease patterns. One of the main objectives of teledermatology established in both developing and developed world is to provide specialist dermatology care.

The first contact care provider is usually a registered doctor with some exception in some developing countries. Setups are based according to their specific disease pattern. But our main focus should be projected on both primary and specialist skincare. The first contact care provider should include both registered and informal healthcare workers; even direct patient contact might be taken into a consideration. Beside different disease patterns, skincare in Bangladesh is also meant to include other specialties like: STDs, sexual dysfunctions including some uro-genital problems!

Store-and-forward teledermatology has been the focus of much interest in recent years. Probably because it can provide similar clinical results when compared with traditional clinic-based consultations[6] and a way of increasing access to dermatological care in rural and under-served areas by using a low technology and low-cost approach.[7] But the most effective outcomes are likely to be achieved by combining the two primary modalities of teledermatology- SAF and RTCs and such hybrid models could form a better foundation of teledermatology consultation in the future.[8] I would also like to increase the role of the service coordinator (Mid Contact), who will be registered doctors with basic dermatology knowledge, beside their clerical duties of conventional SAF tool, also responsible for making an audio communication and providing consultation for basic and emergency disorders. This would be favoured by the patient because of the instantaneous nature of the diagnosis and management regimen and reduce the work load of the consulting dermatologist.

Mobile phone technology has recently been shown to be suitable for teledermatology. Power to capture quality images by in-built high-resolution camera, cost-effectiveness for automating data collection and integrity with telephony for real time consultation make it an important element of the teledermatology process. The ubiquitous presence of mobile phones could be a great untapped potential and hope for initiating teledermatology programs. Mobile phone technology could be a very effective communicating tool between first and mid-contact of the proposed teledermatology processes.

The direct inclusion of patient as a first contact can be debated. Quesrhi illustrated that patients attending a dermatology outpatient clinic would be knowledgeable and capable of participating in teledermatology services.[9] Although the above study dealt with different patient group and level of support within the healthcare system, more and more people in Bangladesh are now getting used to the ICT and telemedicine.

Moreover, some patient might not feel comfortable participating in SAF on the ground of confidentiality, especially female patients in Bangladesh who might prefer their images to be captured by themselves or by near relatives. Such direct contacts would be more cost-effective and might encourage mass participation in the teledermatology project. If the patients are capable to communicate and capture quality images, they should be considered as the first contact as patient-driven healthcare is becoming a reality now a day.

Initiation of such teledermatology programs might face some barriers due to a lack of education amongst participants, inertia among potential users, protest from some of the dermatologists and local healthcare providers etc. Moreover, concerns about the mixed quality of information and images submitted and difficulties in providing comprehensive educative feedbacks to the patients with no local clinician/healthworker to help interpret and answer further questions, scopes for further follow-ups, and opportunities to review diagnoses and management plans should have to be addressed carefully. Side by side improvement of telecommunication infrastructure, high-speed connectivity and low cost tools are also important for creating a good teledermatology platform. Keeping all these in mind, the first step would be the selection of an intuitive, secure and affordable plan.

Conclusion

Teledermatology is not meant to be a replacement for traditional face-to-face consultation. Face to face consultation is essential to skin healthcare and unlikely ever to be replaced by the teleconsultation. But constraints on time and resources will make it ever more expensive and unreachable in the future.[10] Teledermatology holds great potential for revolutionizing the delivery of equitable dermatology services to underserved areas and hard to reach populations. By apprehending the potentiality, many countries are now implementing teledermatology programmes to provide dermatological services to the areas where facilities are inadequate. Bangladesh can not claim an exception to this either. Despite our economic and technical limitations, understanding the present skin health status, we have to move forward with teledermatology– which could be an effective solution.

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A Mobile Community Dermatologic Clinic in Ankober Woreda, Central Ethiopia

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Villages below Ankober escarpment *Photo: Christopher Lovell*

Introduction

Skin diseases represent one of the most frequent causes of morbidity in both rural and urban areas of developing countries[1] affecting up to 60% of the population. This poses a huge work load at primary care level that is compounded by the fact that the conditions are often managed ineffectively[6]. A recent survey by the International Foundation of Dermatology (Hay RJ unpublished data) designed to provide information about community patterns of skin disease in different resource-poor countries indicated that the following were the most common at community level; scabies, superficial mycosis, pyoderma, pediculosis, eczema, HIV related dermatoses, pigment anomalies and acne.[19] The World Health Organization's 2001 report on the global burden of disease indicated that skin diseases were associated with mortality rates of 20,000 in Sub-Saharan Africa in 2001.[1] This burden was comparable to mortality rates attributed to meningitis, hepatitis B, obstructed labour, and rheumatic heart disease in the same region.[1]

Cutaneous disorders are among the three most common causes of morbidity in rural sub-Saharan African countries. Half of these areas have no dermatologist and the few dermatologists in Africa work mainly in secondary and tertiary health care systems in urban surroundings, and are not available to the majority of the population living in rural areas where most dermatoses are diagnosed as "rash" and treated by auxiliary health workers without proper training in this field.[4] Epidemiological data concerning skin disease in many rural areas of sub-Saharan African countries is not available.[4] A number of studies assessing success in the management of skin diseases in primary care settings in Ethiopia find that treatment failure rates of more than 80 % are common.[15]

Skin disease is a frequent and leading cause of morbidity in Ethiopia[3] and the sixth most common reason for outpatient attendance in Ethiopia in 2005, accounting for 3.3% of total patient visits. In Ethiopia there is only one specialized dermatology referral hospital, ALERT (All African Leprosy Education, Rehabilitation and Training) which is the centre for postgraduate dermatovenereology training. It is located in the capital city, Addis Ababa. At present there are only 32 dermatologists serving 78 million Ethiopians. Almost all practice in urban areas, mainly in tertiary healthcare facilities. There is one dermatologist in Gondar, one in Mekele and one in Awassa, but the rest work in Addis Ababa. Of the 32 dermatologists only 16 work in government institutions, the rest are in private practice. It is very difficult to deliver health services to rural communities where 85% of the Ethiopian population live. Populations in most of the rural areas do not benefit from dermatological care and dermatological diseases are often ineffectively managed. People frequently seek cheap treatment by low level healthcare providers, using homemade remedies and buying potentially hazardous non-prescribed drugs.[1]

Objective

To determine the pattern of skin diseases presenting to the mobile dermatology clinic in Ankober Woreda (district).

Location, participants and methods

A mobile dermatology clinic was established in 2008 with funding from Street Spirits ONLUS, a non profit organization in collaboration with Ankober Woreda Development Association, Ankober Woreda Health Bureau, Debre Birhan University and IPO (Increasing People Opportunities). It is the first in its kind in Ethiopia. Ankober is a rural part of Ethiopia on the edge of the great eastern escarpment which bounds the Danakil plains. There is no medical doctor and health services are provided by 15 nurses at the health centres. The mobile clinic was staffed by one dermatologist, two Community Health Workers and a nurse and took place in central health centres in Gorobela and Aliu Amba villages twice a month.

People were informed in advance by a loudspeaker message transmitted at the market places about the visit of the mobile dermatology service. The visits took place from 8.30 a.m. till 6 p.m. The dermatologist also carried out educational and training activities with health centre staff.

Individuals less than 14 years of age presenting to the clinics were defined as children, those greater than 14 years were defined as adults. The clinic's activities over a five month period from February to June 2009 are reported here.

Results

In the five month period of the survey a total of 1426 patients attended the mobile clinic. 849 were above 14 years of age, 421 were between 6-14 years of age and 156 were less than 6 years of age. 58% of the total cases were females and 42% were males.

Of the total child cases seen *(Table 1)* 51 (8.84%) had bacterial skin infection or pyoderma, mainly impetigo; 35 (68.62%) were seen in children aged 6 or under and 16 (31.37%) were between 6 and14 years of age. 83 (14.38%) of children seen had scabies, among these 37 (44.57%) were less than 6 years of age and 46 (55.42%) were between 6 and14 years of age.

Viral skin infections (molluscum contagiosum and viral warts) were seen in 27 (4.67%) children and among those 17 (62.96%)

were <6 years of age and 10 (37.03%) were between the ages of 6 and14 years of age.

There were 3 cases of cutaneous leishmaniasis and one case of cutaneous tuberculosis diagnosed in a child.

Out of a total of 829 patients older than14 years 255 (30.03%) were found to have fungal skin infection *(Table 2)*. Pityriasis versicolor was seen in 205 (80.39%%), tinea corporis 19 (7.45%), tinea pedis 23 (9.02%), onychomycosis 8 (3.14%) and Candida intertrigo 4 (1.57%). The diagnosis of dermatitis included atopic dermatitis 31 (11.8%), contact dermatitis 43 (16.47%), lichen simplex chronicus 56 (21.45%), seborrheic dermatitis 73 (27.9%), nummular eczema, 36 (13.79%), stasis eczema 4 (1.53%), asteatotic eczema 13 (4.98%) and pompholyx 5 (1.91%)

138 (16.25%) of adults had pigment disorders. Of these 124 (89.9%) had melasma,13 (9.42%) had vitiligo, 7 (%.07%) post inflammatory hyper pigmentation, 4 (2.9%) had post inflammatory hypo pigmentation. 66 adults (7.77%) presented with acne vulgaris of whom 53 (80.3%) were females and 13 (19.7%) were males. Chronic skin ulcers were seen in 21 (2.47%) of adults with skin problems, the majority of them (14) were neuropathic skin ulcers seen in treated leprosy patients, 5 stasis ulcers and 3 tropical ulcers. Viral skin infections seen in 18 (2.12%), among them viral warts (12), herpes zoster (2) cases and 4 cases of molluscum contagiosum.

There were seven other cases seen including cases of pruritic papular eruption (2), corn (3), 1 case of erythema nodosum and 1 case of keloid scar.

Table 1: *Frequency of common skin diseases seen in children (<14 years)*

Disease	Age <6 years	Age 6 - 14 years	Total Cases (%)
Pityriasis alba	133	31	164 (28.42%)
Fungal skin disease	51	96	147 (25.82%)
Scabies	37	46	83 (14.38%)
Atopic dermatitis	18	9	27 (4.67%)
Pediculosis capitis	21	64	85 (14.73%)
Viral skin infection	17	10	27 (4.67%)
Pyoderma	35	16	51 (8.84%)
Urticaria	13	5	18 (3.12%)
Others	1	4	5 (0.69%)
Total	**156**	**421**	**577**

Table 2: *Frequency and percentage of patients above 14y ears of age affected by skin diseases*

Skin Disease	No. of Cases	%
Dermatitis	261	30.74%
Fungal skin disease	255	30.03%
Pigmentary disorders	138	16.25%
Acne vulgaris	66	7.77%
Pyoderma	29	3.42%
Chronic skin ulcer	21	2.47%
Psoriasis	20	2.36%
Viral skin infection	18	2.12%
Scabies	15	1.77%
Cutaneous leishmaniasis	12	1.41%
Lichen planus	11	1.29%
Leprosy	9	1.06%
Lymphoedema	6	0.71%
Others	7	0.82%

Table 3: *Frequency of skin diseases seen in the mobile dermatology clinic*

Skin Disease	No. of Cases	%
Eczema	452	31.7%
Fungal skin disease	402	28.19%
Pigmentary disorders	138	9.68%
Pyoderma	80	5.61%
Scabies	98	6.87%
Pediculosis captiis	85	5.96%
Viral skin infection	45	3.15%
Acne vulgaris	66	4.63%
Psoriasis	20	1.4%
Lichen planus	11	0.77%
Cutaneous leishmaniasis	15	1.05%
Leprosy	9	0.63%
Lymphoedema	7	0.49%
Total cases	**1426**	

Discussion

In Ethiopia, skin disease is considered to be a common problem in both urban and rural areas, where more than 80% of children are affected by skin diseases, mainly scabies, pediculosis, tinea capitis and pyoderma.[9]

The pattern of skin diseases identified in children in this study indicates similar results with other community based studies in Ethiopia. The most common skin diseases identified in children in this study 226 (39.12%) were infectious (fungal, bacteria, viral) and 189 (32.76%) were suffering from parasitic infestation such as pediculosis capitis, scabies, insect bites.

Similar results were observed in other community based studies conducted in primary schools in western Ethiopia, where more than 80 percent of randomly examined schoolchildren had at least one infectious or parasitic infestation skin disease which was usually caused by one of four conditions: scabies, pediculosis capitis, tinea capitis, or pyoderma.[9]

A survey conducted in the rural area of in the Zay community of the Zeway Islands, Ethiopia. A total of 4697 people were included in the survey indicated that scabies and fungal skin infections were the most common skin diseases identified (22). Fungal infections were also common in our study group.

Among the total number of cases in children (556) a significant amount of children (164) (28.42%) were affected by pityriasis alba or patchy hypopigmentation and scaling.

Pyoderma was seen most often on children <6years of age. Untreated pyoderma may be complicated by glomerulonephritis. Cases of pyoderma were treated sucessfully by topical Gentian violet & systemic amoxycillin.

Pediculosis capitis affected 95 children;78 (82.1%) occurred in females and 17 (17.89%) of them were males. This difference may be attributed to the cultural habit of shaving or cutting male children's hair very short in local society.

There are differences of common skin problems based on community based and hospital based studies which comparatively shows different pattern of skin diseases. A hospital based study was conducted to determine the pattern of skin disease at the Ethio-Swedish paediatric hospital in Addis Ababa, Ethiopia. A total of 1000 consecutive new paediatric patients, ages 0-12 years, were studied. Allergic skin diseases were most frequently found (55%).

The leading skin problems identified in adult patients above 14 years of age were mainly dermatitis/eczema which is followed by suprerficial fungal skin infection (mycosis).

It was found out that among adults above 14 years of age the majoritiy 261 (30.74%) were affected by eczema and 205 (30.03%) patients were affected by pityriasis versicolor.

Other studies conducted in Ethiopia also indicated similar results of the most common skin diseases.

A tertiary teaching referral study at Black Lion Hospital, Addis Ababa, Ethiopia assessed a total of 1505 patients from June 1995 to July 1997. 1093 (72.6%) were aged 21–40 years. The most common skin diseases were allergic (25.5%) and infections (25.4%).[19] Similar results were obtained from a retrospective study in Tigray Region, Northern Ethiopia, analysing 30618 outpatients and 1103 inpatient medical records from the Italian dermatological centre in Mekele, the regional capital of Tigray during the period from 2005-2007; this study indicated that the leading causes of outpatient attendance were eczema (n:6998) and mycosis (n=5065).[3]

Among the total cases of adults seen with skin problems 138 (16.25%) of them had pigment disorders, notably melasma in 124 (89.9%).

The higher percentage of females than males affected by acne vulgaris and melasma may be attributed to the misuse of impure petroleum jelly and traditional cosmetics on the face.

Conclusion

A number of common treatable diseases account for the vast majority of the skin disease burden in Ethiopia such as infectious skin diseases, parasitic skin infestations and dermatitis/eczema. There is high unmet need of dermatological care in Ethiopia as in other developing countries. Most of these skin diseases are readily treatable, with limited resources and therefore most of the dermatological cases can be managed at peripheral health units in a cost effective and sustainable way, leading to significant health gains for both individuals and communities.

Community based primary health care is a means of providing basic dermatologic care by low level health professionals to the rural population through providing short course training of healthcare workers on the prevalent common skin problems identified in Ethiopia. Specialist dermatologists have an important role to play in developing and overseeing such programmes.

Acknowledgment

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Tungiasis

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Multiple lesions on hand *Photo: Guiseppe Gaido*

Introduction

Tungiasis is an infestation by the burrowing sand flea *Tunga penetrans*, which is found in Central and Southern America, the Caribbean and throughout sub-Saharan Africa. There have also been reports from India and Pakistan. The flea has many common names, being known in various locations as the chigger flea, sand flea, chigoe or jigger.

Pathophysiology

The main habitat for *T. penetrans* is warm, dry soil and sand of beaches, stables, and stock farms. In order to reproduce the flea requires a warm-blooded host and in addition to humans, reservoir hosts include pigs, dogs, cats, cattle, sheep, horses, mules, rats, mice, and other wild animals. The flea, which has limited jumping ability, will invade the epidermis upon contact with unprotected skin. The most common site of involvement is the feet, especially the toes, periungual skin, the sole and the heel, but any part of the skin may be involved, especially if sleeping on soil.

Following penetration of the skin, the flea's abdominal segments expand. The flea's head faces downwards into the upper dermis, allowing feeding from blood vessels, while the caudal tip of the abdomen is at the skin surface, often forming a punctum or a small ulcer. During her gestation the jigger causes a considerable amount of irritation. Pus may form around her distended abdomen, which causes the skin to be raised up into a pea-sized elevation.

Very heavy infestation may cause ulceration resulting in secondary bacterial infection, including , tetanus, lymphangitis, and gas gangrene. Such infections may follow attempts to extract the flea. Autoamputation of digits or other extensive soft tissue debridement is also a possibility. Over 1-2 weeks, more than 100 eggs, which fall to the ground, are individually released from the exposed orifice. Afterwards, the flea dies and is slowly sloughed by the host. The eggs hatch on the ground in 3-4 days, go through larval and pupal stages and become adults in 2-3 weeks. The complete life cycle lasts approximately 1 month.

Symptoms and signs

Patients usually complain of local itching, pain and the sensation of a foreign body. Tungiasis is a dynamic process and the clinical signs depend upon the stage of development of the embedded flea. A recently penetrated sand flea may appear as a black dot surrounded by a small area of erythema. Over the next one to two days the lesion becomes more obvious as an enlarging white papule. As the flea's abdominal segments enlarge over the next two to three weeks a well-defined circular white tense elevated papule develops with a central black dot or ulcer and mild surrounding desquamation. Extruded eggs or faecal threads may be seen on surrounding skin. More advanced infestation may manifest as crusted, erythematous papules, painful, pruritic nodules or crateriform lesions. Secondary infection including lymphangitis and septicaemia may occur.

Investigation

A skin biopsy of a papule or nodule can confirm the presence of the flea but this is rarely necessary as residents in endemic areas know the infestation well. No imaging is necessary unless there is secondary infection with a complication such as gas gangrene.

Differential diagnosis

Conditions to consider in the differential diagnosis of tungiasis include the following:

- Cercarial dermatitis
- Creeping eruption due to Ancylostoma species
- Scabies
- Tick bite
- Flea bites
- Myiasis (Dermatobia hominis)
- Fire ant bites
- Ingrown toenails

Secondarily infected lesions on feet *Photo: Guiseppe Gaido*

Removal of gravid fleas *Photo: Guiseppe Gaido*

Multiple lesions on foot *Photo: Guiseppe Gaido*

Management

Complete extraction of the gravid flea using a sterile needle or dissecting forceps is diagnostic and therapeutic. Following surgical extraction of the flea, thoroughly cleanse and cover the remaining crater with a topical antibiotic cream to prevent secondary infection.

Topical treatment

Topical ivermectin, metrifonate, and thiabendazole have been reported as effective. Occlusive petrolatum suffocates the organism. 20% salicylated petroleum jelly (Vaseline) applied 12-24 hours in profound infestations causes the death of the fleas and facilitates their manual removal[1]. However, these treatments do not remove the flea from the skin, and they do not result in quick relief from painful lesions.

Wearing covered shoes and socks reduces the risk of infestation. The insect repellant Zanzarin, (a lotion consisting of coconut oil, jojoba oil, and aloe vera), has been shown to reduce the number of newly embedded fleas and skin lesions, as well as almost completely reverse the cutaneous pathology, when applied twice daily by residents in an area of high transmission in Northeast Brazil.[2] The intermittent use of Zanzarin, (for one week every second week) can also reduce tungiasis-related acute pathology compared with controls[3]. A more modest effect was seen when Zanzarin was used intermittently for one week every fourth week.

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