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A Novel and Cost Effective Technique of Remote Monitoring of Burn Patients

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Abstract

Management of burn patients is a challenging task because of involvement of multiple systems and high risk of complications. Acute major burns presents with significant physiological and metabolic changes and are associated with high risk of sudden, multiple organ failure. Early, timely and appropriate management of altered physiology based on intensive monitoring findings can significantly reduce burn morbidity and mortality. Another serious threat to these patients is burn wound infection due to compromised immunity, associated co morbidities, extreme ages, cross infection from patients or care givers, inappropriate infection control protocols etc. Hence effective intensive monitoring and simultaneously not breaching the barrier nursing practice can reduce burn related complications and improve outcomes. Usually for burn monitoring nursing staff or doctors comes frequently in contact with the patients, which increases chances of cross infection. Here with this article we would like to share the role of PTZ-IP camera as an effective technique in burn monitoring.

Keywords: Burn; Monitoring; PTZ-IP Camera.

Introduction

Burn patients always require extra attention and effort in order to provide effective treatment, as burn is known for significantly greater morbidity and mortality. As a result various studies have been done to improve the protocols at different centers. Other than routine patient's care burn patients require special attention to effectively manage the altered physiological state, to improve respiratory support, to provide ideal environment for burn wound, early burn wound closure, early enteral nutrition and control of catching or transmission of infection [1.2].

Early burn wound care is effective resuscitation to treat and avoid burn shock, in terms of adequate intravenous fluid transfusion, which constitutes the most effective and challenging step in improving the outcome. In early post burn period, Intensive, frequent and adequate monitoring is necessary to avoid hypervolemia or hypervolemia as both are dreaded complications of fluid replacement, which involve myocardial edema, pulmonary edema, worsening of burn wound, compartment syndrome, need for fasciotomy even in unburned limb etc [3,4]. Effective monitoring plays vital role in making decisions to continue/change the treatment and results in overall improvement of outcomes [5].

Burn wound sepsis is another known complication of burn wound which directly affects morbidity and mortality. Patients are prone to develop hospital acquired infections due to reduced immunity and loss of protective barrier of skin. Sepsis and infection have many criteria routinely found in patients with extensive burns e.g., fever, tachycardia, tachypnea, leukocytosis. Primordial prevention for effective prevention of infection involves adequate wound management and timely and appropriate antibiotics [6,7]. Tele-barrier nursing plays a crucial role as an adjunct to avoid sepsis and related complications.

As monitoring of burn patient involves frequent contact of patient with nursing staff, treating doctors and patient's relatives, simple measures taken to control the transmission of infection can produce significant improvement in outcomes. Remote monitoring is becoming an important technique for monitoring while maintaining barrier nursing [8]. Through this article we would like to present a simple and cost effective technique of monitoring of burn

patients which simultaneously helps in prevention of infection by maintaining the barrier nursing.

Methodology

This is a retrospective observational study performed in the tertiary burn care centre of our institute from November 2015 to April 2016. Patients with major burn were admitted in burn ICU and managed according to standard protocols followed in institute. Apart from those protocols we started using an audiovisual monitoring aid comprising wall mounted IP camera (Macroplus Robot Ball HR101-W wireless camera) with a resolution of 720 p with live HD streaming (Figure 1). The camera was synchronized to the mobile phone of the consultant, duty doctors, nursing staffs and also through an application installed on a tablet that provides video chat and voice call services using the IP address. Consultants can watch patient's vitals on bed side monitor any time on their smart phone through freely downloaded mobile software (Figure 2). Consultant can watch all patients of the ward by virtue of rotation property of the camera, he/she can watch patient's position, dressing status, splints etc (Figure 3). As the system is provided with speaker, consultant can provide on line advice to the duty doctor or staff nurse. The device also has inbuilt audio and video recording in addition to online transmission facility. Apart from patient's monitoring from outside, attendants were also allowed to interact with their patients through the tablet/ mobile to promote barrier nursing (Figure 4a, b). Apart from usual bed side monitoring, all patients were monitored intensively by wall mounted IP camera after initial resuscitative measures were completed.

All nursing staffs, resident duty doctors and consultants were in on-line contact by synchronizing the mobile/ tablet through voice/ video calls using IP address.

Apart from usual rounds consultants were in almost continuous contact with the patients by using online audio visual modalities, and instructions were given accordingly to duty doctors or nurses. Another tablet was kept outside the ICU and patient's relatives were allowed to see/talk to their patients. Satisfaction of patient and relatives was assessed on a five point scale using the parameters of Availability of basic amenities, satisfaction with cost of services, information and communication, relationship between patient and health providers. Level of satisfaction was recorded by selecting responses ranging from poor=1, fair=2, good=3, very good=4 and excellent=5. Point 1 and 2 was considered dissatisfied while points 3, 4 and 5 were considered satisfied [9].

At the end of the study period, the feedback was taken from consultants, residents and staff nurse was analysed to evaluate the effectiveness.

Audit result of HICC was used to assess the efficacy of this modality in infection control (Figure 5a, 5b).

Fig. 1: Wall mounted IP camera

Fig. 2: Synchronized mobile and tablet showing monitor reading

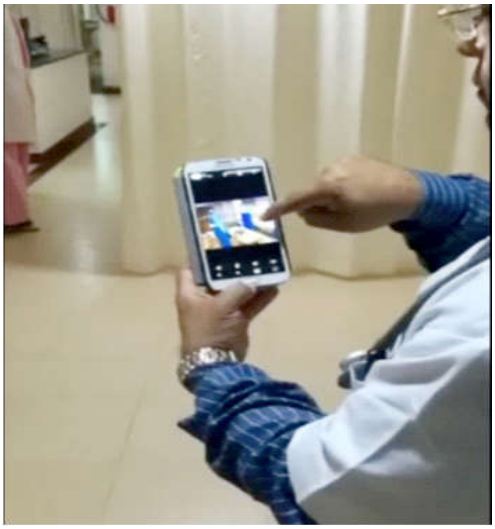

Fig. 3: Consultant watching patient's status on mobile by synchronizing with IP camera

Fig. 4a: Relative communicating with her

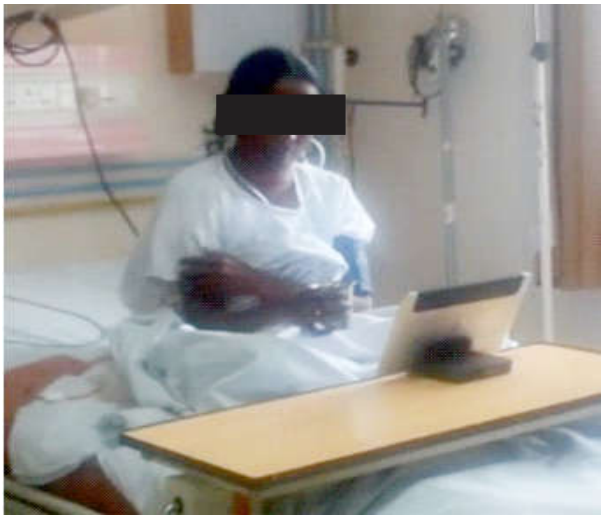

Fig. 4b: Patient communicating from inside patient via synchronized tablet kept outside

Result

Total 18 patients were included in the study (Table 1). 4 (22.22%) patients were pediatric and 14 patients (77.77%) were adult patients. 8 patients (44.44%) were male and 10 (55.55%) patients were female. Male female ratio was 4:5.

11 patients (61.11%) were having TBSA more than 50%. While 7 patients (38.88%)) were having TBSA less than 50 %. Mean TBSA involved was 63.33 %. 10 (55.55%) patients had thermal burn, 4 (22.22%) patients had scald burn and 4 (22.22%) patients had electric burn. 2 patients (11.11%) were presented within 3 hours of burn. 4 patients (22.22%) were presented within 6 hours of burn, whereas 11 patients (61.11%) were presented beyond 6 hours of burn with inadequate resuscitation.

3 patients (16.66%) were presented delayed as old and infected burn wound with features of sepsis. 5 patients (27.77%) were having associated co morbidities. 10 patients (55.55%) presented with components of inhalational burn. Out of which 7 patients underwent prophylactic life saving emergency tracheostomy with informed consent. All patients required intra venous fluid via central line or venous cut down or peripheral line. 5 patients were kept on ventilatory support.

All patients were monitored intensively by wall mounted IP camera after initial resuscitation.

4 consultants, 6 resident doctors and 12 nursing staffs were involved in the study. Consultant doctors, duty doctors, staff nurses were patients and their relatives were found to be satisfied with the score ≥3. Average satisfaction score for consultants was 4.5, for resident doctors was 4 and for nursing staff was 4.5. Patient-relative interaction was made for all patients. Average satisfaction score for relatives was 4.2. Patient-relative interaction was found to effective in relieving depression in patients and counseling of relatives regarding severity and prognosis of their patients. As a result relatively less number of in person contacts were made between patient and relatives/ hospital staffs which showed a drop in infection rate, declared in HICC (Hospital Infection Control Committee) report (Figure 5a, 5b).

Discussion

Tele monitoring is a branch of telemedicine. The call for medical help remotely marks the first event in modern TM. Historically African villagers were using smoke signals to warn the people in case of serious diseases. In early 1900s people of remote areas used two-way radios to communicate with Royal Flying service of Australia. While first interactive telemedicine system was launched in America, which was performed to diagnose and treat patients requiring cardiac resuscitation [10]. Telemedicine can be broadly classified into. Store and forward (SAF) or pre-recorded (asynchronous) TM, Real-time or video conference (VC) (synchronous) TM, Hybrid TM, Mobile or cellular TM, Integration model [11].

Remote monitoring involves self monitoring and testing, doctor can monitor a patient remotely using various technological devices. These services are primarily used for monitoring chronic diseases like, diabetes mellitus, heart disease, and hypertension or asthma [12].

Hospital Infection Control Committee Jipmer Hospital, Acquried Infection servellance report October 2015

Block	ICU	VAP Rate		CLABSI Rate		CAUTI Rate		SSI Rate	Burn Wound Infection Rate	Bed sore rate	Sheath
		JIPMER	NHSN 75 Perceutile	JIPMER	NHSN 75 Perceutile	JIPMER	NHSN 75 Perceutile	JIPMER	JIPMER	JIPMER	JIPMER
EMS	Burns	0.00	6.7	0.00	5.2	11.49	8.1	0.00	12.50	0.00	0.00
	CCCU	0.00	1.3	0.00	1.9	0.00	3.5	0.00	-	0.00	0.00
	CCU	22.73	1.3	0.00	1.9	0.00	3.5	0.00	-	59.60	0.00
	TC ICU	34.88	6	0.00	2.4	0.00	5.6	0.00	-	0.00	0.00
	MICU	20.74	1.6	0.00	1.9	2.16	3.9	0.00	-	0.00	0.00
MAIN	Ward 43 Step down ICU	0.00	1.6	0.00	1.9	6.54	3.9	0.00	-	0.00	0.00
	SICU	0.00	3.1	0.00	1.8	0.00	2.5	7.14	-	8.73	0.00
	32-A ICU	31.25	3.1	0.00	1.8	13.70	2.5	100.00	-	0.00	0.00
	EMT	0.00	2.8	0.00	1.2	0.00	2.5	0.00	-	0.00	0.00
	CTVS ICU	30.30	2.5	8.13	1.2	0.00	2.5	4.00	-	0.00	0.00
	KIP	0.00	2.8	0.00	1.2	58.82	2.5	0.00	-	0.00	0.00
	NUEROMED ICU	33.90	2.5	27.52	1.6	20.41	5	0.00	-	0.00	0.00
	Nueromed ICU	38.82	2.9	0.00	1.9	27.59	6.2	0.00	-	0.00	0.00
SSB	PAED SURG ICU	52.63	0.9	48.78	2.1	27.78	3.8	21.05	-	0.00	0.00
	PL SURG ICU	0.00	2.8	0.00	1.2	0.00	2.5	0.00	-	0.00	0.00
	RCC ICU	0.00	1.3	19.23	1.5	0.00	2.3	0.00	-	0.00	0.00
	SGE ICU	0.00	2.8	0.00	1.2	0.00	2.5	0.00	-	0.00	0.00
	URO ICU	0.00	2.8	0.00	1.2	0.00	2.5	0.00	-	0.00	0.00
	SURGICAL ONCOLOGY ICU	0.00	2.8	0.00	1.2	0.00	2.5	0.00	-	0.00	0.00
WCH	NICU	10.93	<750gm-24 >750gm-00	31.53	<750gm-4.9 >750-3.3	0.00	0	0.00	-	0.00	0.00
	PICU	0.00	0.9	13.89	1.5	0.00	3.1	1.45	-	0.00	0.00
JIPMER (ICU AVERAGE)		14.10		7.10		8.02		6.36	12.50	3.25	0.00

Fig. 5a: Committee report showing burn wound infection rate before application of remote monitoring.

Hospital Infection Control Committee Jipmer Hospital, Acquried Infection servellance report October 2015

Block	ICU	VAP Rate		CLABSI Rate		CAUTI Rate		SSI Rate	Burn Wound Infection Rate	Bed sore rate	Sheath
		JIPMER	NHSN 75 Perceutile	JIPMER	NHSN 75 Perceutile	JIPMER	NHSN 75 Perceutile	JIPMER	JIPMER	JIPMER	JIPMER
EMS	Burns	0.00	6.7	0.00	5.2	12.35	8.1	0.00	-	0.00	0.00
	CCCU	0.00	1.3	0.00	1.9	0.00	3.5	0.00	-	0.00	0.00
	CCU	20.98	1.3	0.00	1.9	5.88	3.5	0.00	-	0.00	0.00
	TC ICU	0.00	6	0.00	2.4	0.00	5.6	0.00	-	0.00	0.00
	MICU	10.05	1.6	3.75	1.9	4.39	3.9	0.00	-	0.00	0.00
MAIN	Ward 43 Step down ICU	0.00	1.6	0.00	1.9	6.10	3.9	0.00	-	0.00	0.00
	SICU	31.58	3.1	0.00	1.8	0.00	2.5	4.35	-	8.89	0.00
	32-A ICU	20.83	3.1	0.00	1.8	0.00	2.5	100.00	-	0.00	0.00
	EMT	0.00	2.8	0.00	1.2	0.00	2.5	0.00	-	0.00	0.00
	CTVS ICU	18.87	2.5	0.00	1.2	9.17	2.5	3.45	-	11.30	0.00
	KIP	0.00	2.8	0.00	1.2	0.00	2.5	0.00	-	0.00	0.00
	NUEROMED ICU	61.22	2.5	12.05	1.6	52.24	5	0.00	-	0.00	0.00
	Nueromed ICU	21.51	2.9	0.00	1.9	6.71	6.2	9.52	-	9.52	0.00
SSB	PAED SURG ICU	58.82	0.9	0.00	2.1	14.49	3.8	15.00	-	0.00	0.00
	PL SURG ICU	0.00	2.8	0.00	1.2	0.00	2.5	0.00	-	32.61	0.00
	RCC ICU	0.00	1.3	11.36	1.5	0.00	2.3	0.00	-	0.00	0.00
	SGE ICU	111.11	2.8	0.00	1.2	0.00	2.5	17.86	-	0.00	0.00
	URO ICU	0.00	2.8	0.00	1.2	27.27	2.5	5.26	-	0.00	0.00
	SURGICAL ONCOLOGY ICU	0.00	2.8	0.00	1.2	0.00	2.5	10.53	-	0.00	0.00
WCH	NICU	0.00	<750gm-24 >750gm-00	17.96	<750gm-4.9 >750-3.3	0.00	0	0.00	-	0.00	0.00
	PICU	0.00	0.9	4.06	1.5	5.62	3.1	0.00	-	0.00	0.00
JIPMER (ICU AVERAGE)		16.90		2.34		6.87		7.90	12.69	2.97	0.00

Fig. 5b: Committee report showing reduced burn wound infection after application of remote monitoring

Cellular TM is an effective tool in modern practice of medicine because tools are portable, easy to handle, relatively low cost, incorporation of modern technologies in smart phones. They provide immediate image access and direct interaction, and it is possible to obtain clarification. Quality, speed of image transmission and live video streaming is no longer an obstacle due to availability of higher band width networks. New generation cellular phones allow taking good-quality images and transmitting them directly to other cellular phones/ tablets (via multimedia messages) and computers (via e-mail or blue tooth-wireless connection) with diagnosis agreement of 82% compared to face-to-face consultation. Mobile technology has helped significantly in the field of telemedicine [13].

Telemonitoring is another form of telemedicine where sick patients are being monitored intensively and more frequently by using electronic media [14].

It may not be possible for the consultant to be present every time near the patients to advice or guide he duty doctors or staff, telemonitoring enables the clinician to be in contact with their patients all the time without compromising his duties towards other patients in the hospital. Hence monitoring of one patient should not deprive other patients from the care givers. Remote Patient Monitoring is a system which uses electronic media to collect and transfers medical or health related data from the point of care and transfers to another health care provider locate at distance to assess and advice for management. The time saved by utilizing remote patient monitoring allows the health care provider to provide more time to remotely communicate and educate the patients and relatives [15].

Ideal monitoring of major burn patients should be reliable, frequent, intensive, preventing transmission of infection, support barrier nursing. Remote patient monitoring is also an important part of home based monitoring of chronically ill patients like COPD, chronic kidney diseases, chronic heart disease etc.

Need of Remote Monitoring of Burn Patients

Burn is one of the commonest emergencies in plastic surgery. Major burn patient require significant amount of attention and care by doctors, nurses and family members. Acute burns are almost always associated with significant physiological changes at the time of presentation and hence their prognosis and course of disease is highly unpredictable. Any failure of timely intervention to a critical alteration can lead to fatal complications. Hence early recognition and timely intervention can prevent complications and save patient's life. Shortage of man power and increased patient load in burn centers hinders the effectiveness of monitoring, a remote monitoring tool may be very helpful for burn patients so that limited number of health care providers can monitor more patients simultaneously without compromising care to other patients. Our article highlights the use of cost effective, reliable and user friendly remote monitoring tool for monitoring of burn patients.

Conclusion

Based on our experience, PTZ-IP camera is a cost effective, easy to install and user friendly tool for monitoring of burn patients.

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An Observational Study of the Spectrum of Mucocutaneous Manifestations of Diabetes Mellitus in Mumbai, India

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Abstract

Introduction: The skin manifestations of diabetes mellitus (DM) are important, to prevent cutaneous complications, and to detect diabetes based upon the suspicion raised from certain dermatoses. *Methods:* In this hospital-based, non-interventional, observational study, 250 diabetic patients of either gender were evaluated for cutaneous manifestations of diabetes. Patients were categorized into obese and non-obese, and the percentages of various dermatoses in the study population was calculated and compared with similar Indian published studies. *Results:* The proportion of men was higher, and the peak incidence of DM with cutaneous manifestation was in 40-70 years of age (72.8%). Of the total cases, 66 (26.4%) were obese. Majority of cutaneous manifestations associated with DM were infections, seen in 110 patients (44%), with fungal infections being most common (65 cases, 26%), followed by bacterial infections (36 cases, 14.4%). Cutaneous markers of metabolic syndrome including acanthosis nigricans, and xanthelasma palebrarum were also seen. Disorders of immune dysregulation such as psoriasis lichen planus alopecia areata, and vitiligo were seen in a substantial number of cases. However, specific diabetes-associated skin disorders were sparingly encountered; necrobiosis lipoidica diabeticorum, and sclererderma diabeticorum were not seen. Diabetic foot ulcers were seen in 13 cases (5.2%). *Conclusion:* In view of the high incidence of cutaneous infections in diabetics, they must be closely monitored for the same for early treatment. The association of psoriasis, lichen planus, vitiligo, alopecia areata etc. can be explained on the common pathogenetic involvement of a dysregulated immunity. Complications like foot ulcers are common and need early intervention.

Keywords: Cutaneous; Skin; Diabetes; Infections; Ulcer.

Introduction

Diabetes mellitus (DM) is the most common endocrine disorder characterized by the abnormalities of insulin levels and elevated blood glucose level leading to metabolic, vascular, neurological and immunological abnormalities. Affected organs include the cardiovascular, renal and nervous system, eyes and the skin [1]. This chronic disease affects 11 million individuals in the United States, of these 90% have type II, non-insulin dependent whereas 10% have insulin dependent type I [2]. Diabetes has emerged as a major healthcare problem in India. According to Diabetes Atlas published by International Diabetes Federation (IDF), there were an estimated 40 million persons with diabetes in India in 2007 and this number is predicted to rise to almost 70 million people by 2025 [3].

Diabetes has been classified into various types; however, the two primary forms are type 1 diabetes mellitus or T1DM (formerly called insulin dependent diabetes mellitus or IDDM) and type 2 diabetes mellitus or T2DM (formerly called non-insulin dependent diabetes mellitus or NIDDM), the latter constituting almost 85% of the total global patient population of DM. Other major subsets of the spectrum of DM include maturity onset diabetes of the young (MODY), gestational diabetes (GDM), drug-induced hyperglycemia, pre-diabetes, impaired glucose tolerance (IGT), amongst others.

Cutaneous manifestations described in diabetes mellitus may vary from trivial to life threatening. However none is absolutely pathognomonic of the disease. However, certain cutaneous markers are readily recognizable as diabetic markers and are considered as virtually diagnostic of diabetes

mellitus; e.g. Necrobiosis lipoidica diabeticorum (NLD), bullous diabeticorum, waxy skin syndrome and diabetic dermopathy [4]. Cutaneous manifestations in diabetes have been reported to have an incidence ranging from 30-40% [2,5]. The clinical manifestations and complications of skin disease are frequently more severe in the setting of diabetes. The literature abounds with studies that attempt to identify and understand the pathophysiology of cutaneous disorder in the diabetes patients. A systematic classification of cutaneous manifestations of diabetes mellitus has been attempted by A C Huntley, detailed in Box 1 [6].

Dermatologists, diabetologists and clinicians often neglect the dermatoses associated with diabetes mellitus. Moreover conflicting and overlapping nomenclature have added to the confusion. Thus, an early recognition of these cutaneous manifestations provide an important "window of opportunity" for the early diagnosis and treatment of diabetes mellitus and consequently reduce the morbidity caused by the associated systemic complication of untreated hyperglycaemia. Thus, this study was undertaken to study the spectrum of dermatoses associated with diabetes mellitus and estimate their proportions in Indian population.

Methodology

This was a hospital-based, non-interventional, observational study of cutaneous manifestations in Indian patients with diabetes mellitus. The study was conducted in the Department of Dermatology, Venereology & Leprology in K. J. Somaiya Hospital & Research Centre, Mumbai, India. It was approved by the institutional ethics committee.

All patients with diabetes mellitus, visiting the Department of Dermatology and Venereology (outpatient and inpatient) of the study centre, during the period of 2 years from April 2008 to April 2010 were included in the study and 250 sequentially presenting cases were examined. Patients of all ages and both sexes diagnosed to have diabetes mellitus with cutaneous manifestations were included. Patients with any other disease causing an immunocompromised state, and those on immunosuppressive medication were excluded from the study. A written consent of for enrolment in the study was taken from all patients and clinical photographs were maintained.

A detailed history was taken as per a specially designed clinical record form (CRF) with particular reference to cutaneous complaints, any other significant systemic association and treatment modality, if any. A thorough clinical examination was done with special emphasis on examination of the entire integumentary system, including the skin, hair, nails, oral mucous membrane, genital mucosa, and perianal areas. Body mass index (BMI) was calculated for each patient In the present study, BMI was calculated using the Quetelet's index (BMI = weight in kg/ height in m^2); BMI $\geq$ 30 for males and BMI $\geq$ 28.6 for females was used as a cut-off value to define obesity.

Patient investigations included a complete blood count (CBC) with erythrocyte sedimentation rate (ESR), fasting blood sugar (FBS) and post-prandial blood sugar (BS-PP), urine examination (routine and microscopy). The other investigations were tailored as per the cutaneous lesions found in the patients (Box 2).

Data analysis was done by calculating proportions and percentages of various dermatoses in the study population (i.e. 250 diabetics with cutaneous manifestations) and was compared with similar Indian and International studies.

Results

Demography and Patient Profile

A total of 250 cases were included in this study that comprised of 139 male patients (55.6%) and 111 female patients (44.4%). The age of patients ranged from 18 years to 90 years old [Figure 1]. The peak incidence of DM with cutaneous manifestation was in 40-70 years of age (72.8%). The incidence was less in young patients and after 80 years. Of the included patients, 249 (99.6%) had T2DM and only 1 (0.4%) had IDDM. A positive family history of diabetes was elicited in 28% of cases (36 male and 34 female patients). Based on the BMI, 184 cases (73.6%) were found to be non-obese whereas remaining 66 (26.4%) were diagnosed to be obese, comprising of 29 male and 37 female patients [Figure 2].

Cutaneous Manifestations [Figure 3]

Majority of cutaneous manifestations associated with DM were infections, seen in 110 patients (44%), of which fungal infections were detected in 65 cases (26%), bacterial infections in 36 cases (14.4%), and viral infections in 9 cases. Infestations like scabies were seen in 4 cases (1.6%).

Cutaneous markers of metabolic syndrome were seen in few cases; acanthosis nigricans (AN) in six

cases (2.4%), and xanthelasma palebrarum (XP) in 4 cases (1.6%). Disorders of dysregulated immunity were encountered as follows: psoriasis in 16 cases (6.5%), lichen planus (LP) in 11 cases (4.4%), alopecia areata in 9 cases (3.6%), and vitiligo in eight cases (3.2%). Specific diabetes-associated skin disorders were sparingly encountered; 13 cases (5.2%) of diabetic ulcer of the foot, and one case each (0.4%) of diabetic hand syndrome and granuloma annulare (GA). No case of NLD or sclerederma diabeticorum was observed.

Cutaneous Infections

Out of 36 patients (14.4%), who were diagnosed with bacterial infections [Table 1], pyoderma were present in 27 patients (10.8%) and erythrasma in two patients (0.8%) followed by leprosy in seven patients (2.8%). The pyodermas detected during the study included furunculosis (14 cases, 5.6%), folliculitis (4 cases, 1.6%), carbuncle (4 cases, 1.6%), cellulitis (3 cases, 1.2%), ecthyma (1 case, 0.4%) and erysipela (1 case, 0.4%). Carbuncles, are clusters of contiguous furuncles interconnected subcutaneously resulting in edematous and abscess-like swelling with a perforated surface giving a "sieve-like" appearance, and typically located over the neck region [Figure 4]. Out of the 29 cases of bacterial infections (excluding 7 cases of leprosy), 18 (62.1%) showed positive gram staining from the collected specimen. Majority of these gram stain positive cases revealed gram positive cocci arranged in clusters, confirmed to be *Staphylococcus aureus*. Out of the seven cases of leprosy encountered in the study, one patient of lepromatous leprosy (LL) had concomitant severe erythema nodosum leprosum with necrotic lesions [Figure 5].

Analysis of different types of fungal infections [Table 2] showed that tinea cruris and corporis were the commonest forms, accounting for 31 cases (12.4%) closely followed by tinea pedis in four cases (1.6%) and tinea faciei in two cases (0.8%) only. Candidal infections including vulvovaginitis, balanoposthitis, intertrigo, and paronychia were encountered in 15 cases (6%). Toe intertrigo involved multiple toe clefts and revealed hyperkeratotic adherent white membrane. Pityriasis versicolor was seen in five cases (2%), and onychomycosis in 7 cases (2.8%). Onychomycosis typically involved multiple nails with toe > finger nail involvement; the most common morphological type being total dystrophic onychomycosis [Figure 6]. A single case (0.4%) of pulmonary and cutaneous cryptococcosis was observed in the study; with clinical features of two umbilicated nodules [Figure 7], and a 3cm nodule in right upper lung field detected on chest X-ray. This patient was seronegative for HIV infection. Fungal elements were detected on 10% KOH mount and positivity was detected in 48/65 (78.4%) cases of mycoses. Of the 9 cases with viral infections, four had herpes labialis (1.6%), two had herpes zoster (0.8%), two had verruca vulgaris (0.8%), and one patient (0.4%) was detected with herpes progenitalis. Scabies was detected in 4 cases (1.6%).

Cutaneous Markers of Metabolic Syndrome

Acanthosis nigricans was observed in six cases (2.4%), all being obese. The characteristic 'hills and valley' morphology of AN in all the 6 cases involved the neck as well as the axillae [Figure 8]. All these patients also had AN-associated acrochordons (skin tags). Additionally, acrochordons as a stand-alone skin finding was seen in two diabetic patients (0.8%). Yellow soft papules of XP over the eyelids were observed in 4 cases (1.6%).

Papulosquamous Disorders

Apart from psoriasis (16 cases, 6.5%) and LP (11 cases, 4.4%), 10 cases of eczema were found in this study. The lesions were hyperpigmented scaly plaques with or without discharge. The morphological variants included – lichen simplex chronicus (LSC), stasis dermatitis, contact dermatitis and nutritional dermatitis. Of the 11 cases with LP, two cases had additional ulcerative lesions of LP involving the buccal mucosa. Seven cases of LP were confirmed histopathologically.

Lichen amylodosis with multiple, discrete, pruritic, popular lesions over the anterior aspect of both lower legs was detected in 4 cases (1.6%). Seven cases (2.8%) of acquired icthyosis were observed in this study. The lesional skin was dry with fine, fissured scales that appeared 'posted-on' the body surface. The lesions were more prominent on the extensor aspect of the lower extremities.

Specific DM-Associated Skin Disorders

Specific diabetes-associated skin disorders were sparingly encountered; 13 cases (5.2%) of diabetic ulcer of the foot [Figure 9], and one case each (0.4%) of diabetic hand syndrome and granuloma annulare (GA).

The patient with diabetic hand syndrome displayed limited mobility of phalanges, and severe contraction of proximal and distal interphalangeal joints resulting in the inability to approximate the palms with fingers fanned out (Prayer sign). No case of NLD or sclerederma diabeticorum was observed.

Miscellaneous Dermatoses

Six cases of urticaria were diagnosed in non-obese NIDDM patients. Lesions consisted of multiple transient, erythamatous papules and oedematous plaques and wheals distributed all over the body. Etiology of the same could not be established by detailed history, clinical examination and relevant investigation. Five patients (2%) were detected with Schamberg's purpura. Rosacea was found in 3 patients (1.2%). Three cases of multiple seborrhoeic keratosis (SK) were detected. Three cases (1.2%) of Kyrle's disease were detected. The lesions presented predominantly over the distal extensor aspect of the extremities and consisted of discrete perifollicular as well as interfollicular hyperkeratotic papules with adherent keratotic plugs [Figure 10]. Koebner's phenomenon was seen on the trunk in two of these patients. One case each of pangeria, burning feet syndrome, stucco keratosis, and prurigo simplex were diagnosed.

Box 1: Classification of cutaneous manifestations of diabetes mellitus[6]

A) Infections
- a) Bacterial
  - i. Pyoderma (especially from *Staphylococcus aureus*)
  - ii. Malignant external otitis (*Pseudomonas aeruginosa*)
  - iii. Necrotizing fasciitis (Gram-positive and Gram-negative and anaerobic mixed infection)
  - iv. Erythrasma
- b) Mycotic
  - i. Superficial – Dermatophytosis / candidiasis
  - ii. Deep – Mucomycosis

B) Skin changes thought to be related to microangiopathy
- a) Punched-out skin ulcer on lower legs.
- b) Necrobiosis lipoidica diabeticoru
- c) Diabetic dermopathy (Shinspots)
- d) Bullous eruption of diabetes
- e) Rubeosis

C) Skin changes thought to be related to neuropathy
- a) Neurotrophic ulcer (mal perforans)
- b) Charcot joints

D) Skin changes thought to be related to macrovascular insufficiency
- a) Ischemic skin ulcers and digital gangrene
- b) Erysipelas-like erythema

E) Skin changed related to lipodystrophy
- a) Lipodystrophy at insulin injection sites
- b) Syndromes of lipodystrophy and diabetes
  - i. Seip-Berardinelli syndrome [Congenital Generalized Lipodystrophy (CGS)]
  - ii. Acquired lipodystrophy

F) Other skin diseases that may be associated with diabetes
- a) Granuloma annulare
- b) Scleredema diabeticorum (adultorum)
- c) Eruptive xanthomas
- d) Perforating cutaneous diseases (of diabetes)
- e) Pruritus
- f) Vitiligo
- g) Acanthosis nigricans

G) Drug reactions
- a) Insulin reaction – local wheal, urticaria
- b) Oral hypoglycemic reaction.
  Can cause unpleasant flushing reaction after alcohol ingestion and can cause hyponatraemia by increasing action of ADH.

According to S.D.D. Griffiths[7], cutaneous manifestations of diabetes mellitus are classified as:
- a) **Well defined link to diabetes**
- Pigmented pretibial patches
- Necrobiosis lipoidica diabeticorum

- Granuloma annulare
- Neuropathic ulcer
- Decreased sweating
- Atherosclerosis
- Skin infections
- Lipoatrophic diabetes
- Carotenaemia
- Secondary xanthomas
- Anogenital itching and vulvodynia
- Limited joint mobility and waxy skin syndrome

b) **Possible link to diabetes**
- Vitiligo
- Alopecia areata
- Idiopathic bulla
- Rubeosis faciei (red face)
- Generalized itching
- Dupuytrens contracture
- Scleredema diabeticorum

b) **Doubtful link to diabetes**
- Psoriasis
- Campbell de Morgan spots

According to Chilukuri Sreedevi, Ivana Palvic, Renar et al, cutaneous manifestation in diabetes mellitus are classified as[15]:

I) Dermatologic lesions and associations which are specific for diabetes mellitus.
a) Pruritus
b) Necrobiosis lipodica diabeticorum
c) Granuloma annulare
d) Diabetic dermopathy
e) Scleroderma diabeticorum
f) Acanthosis nigricans
g) Diabetic bullae

II) Skin alterations due to diabetic complications
a) Diabetic foot
b) Cutaneous infections associated with diabetes
- Bacterial skin infections:
- Furunculosis
- Carbuncle
- Pyodermas
- Candidiasis
- Dermatophytosis

c) Erythrasma
d) Xanthomatosis
e) Xanthelesma
f) Limited joint morbility and waxy skin syndrome
g) Malignant otitis media

III) Dermatologic changes associated with neurovascular complication
a) Macroangiopathy
b) Microangiopathy
c) Diabetic neuropathy

IV) Dermatologic complication of diabetes treatment
a) With oral hypoglycemic drugs
b) Insulin induced disorders

V) Endocrine syndromes with skin alterations and diabetes mellitus
Necrolytic migratory erythema in glucagonoma syndrome

VI) Dermatosis those are more common in diabetes mellitus
a) Perforating dermatosis
b) Lichen planus
c) Eruptive xanthomas
d) Kaposi's sarcoma
e) Bullous pemphigoid
f) Dermatitis herpetiformis
g) Psoriasis.

Box 2: Special investigations undertaken in study patients as per the cutaneous features

- Wood's lamp examination
- Skin scraping and 10% KOH (potassium hydroxide) mount for fungal study
- Gram stain from skin swab/cutaneous discharge
- Fungal culture for speciation – skin scraping/nail clipping/hair follicle
- Tzanck smear
- Skin biopsy (hematoxylin & eosin, and special stains when required)
- Lipid profile
- VDRL test
- Serology for HIV-1 and HIV-II

Table 1: Incidence of different bacterial infections in 250 patients of diabetes mellitus

Fungal infections	No. of cases	Percentage
Tinea cruris	16	6.4
Tinea corporis	15	6
Tinea pedis	04	1.6
Tinea faciei	02	0.8
Candidal balanoposthitis	04	1.6
Candidal intertrigo	04	1.6
Onychomycosis	07	2.8
Pityriasis versicolor	05	2.0
Vulvovaginal candidiasis	06	2.4
Paronychia	01	0.4
Cryptococcosis	01	0.4
Total	**65**	**25.6**

Table 2: Incidence of different fungal infections in 250 patients of diabetes mellitus

Bacterial infections	No. of cases	Percentage
Furunculosis	14	5.6
Folliculitis	04	1.6
Carbuncle	04	1.6
Cellulitis	03	1.2
Ecthyma	01	0.4
Erysipelas	01	0.4
Erythrasma	02	0.8
Leprosy	07	2.8
Total	36	14.4

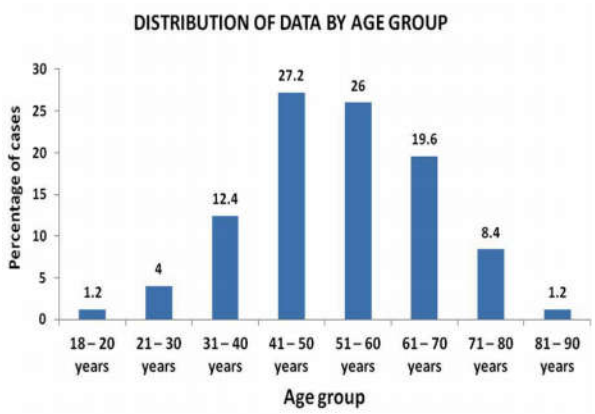

Fig. 1: Age distribution of the study patients

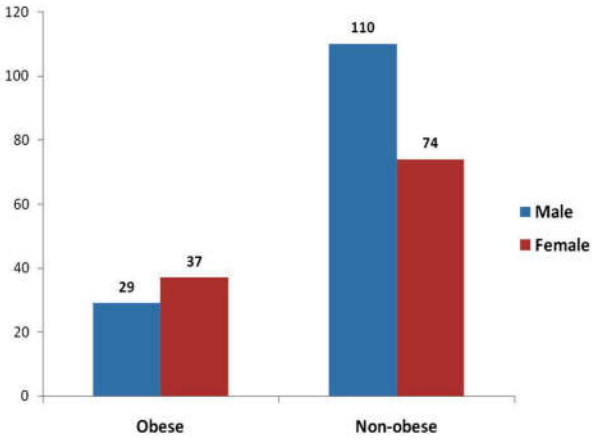

Fig. 2: Gender-wise distribution of study patients with diabetes mellitus with/without obesity

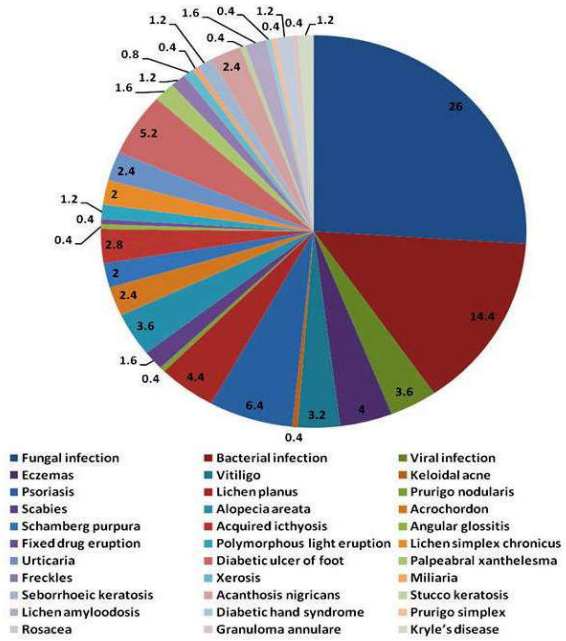

Fig. 3: The incidence of cutaneous manifestations observed in 250 patients with diabetes mellitus in the study

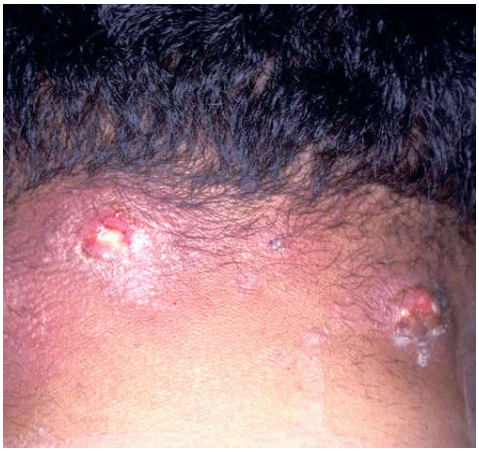

Fig. 4: Carbuncles over the neck of a 42-year old diabetic man; note the inflamed ulcer with a 'sieve-like' appearance with pus points

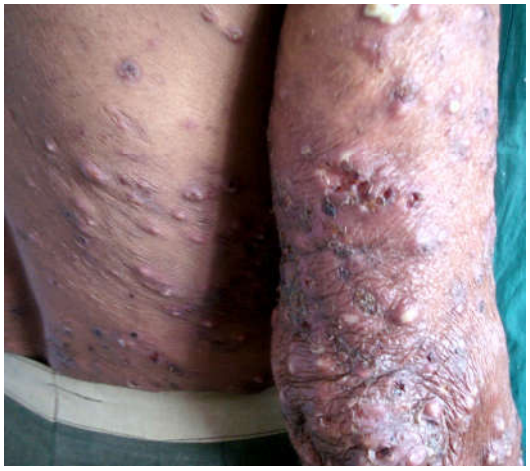

Fig. 5: Necrotic lesions of erythema nodosum leprosum (ENL) in a 60-year-old diabetic patient with lepromatous leprosy

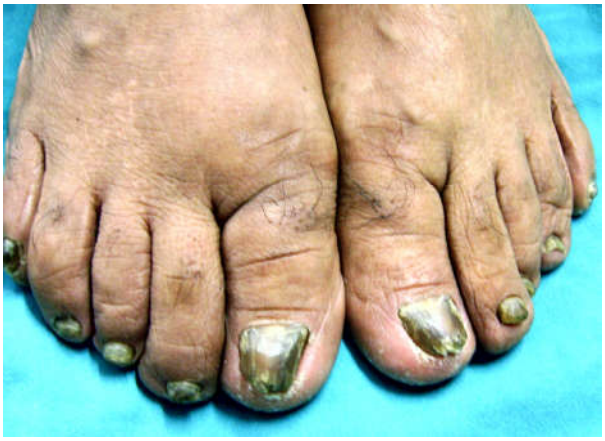

Fig. 6: Total dystrophic onychomycosis involving all toe nails in a 55-year old man with uncontrolled type 2 diabetes mellitus

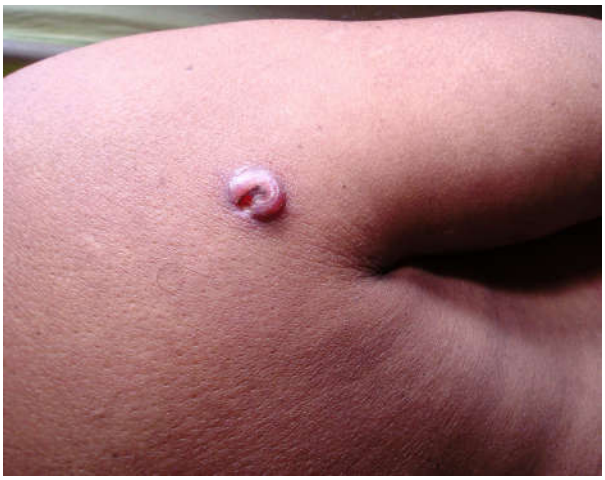

Fig. 7: Hyperkeratotic umblicated nodule over the posterior aspect of the right arm of a 34-year old seronegative diabetic patient, confirmed to be cutaneous cryptococcosis on histopathology and fungal stains.

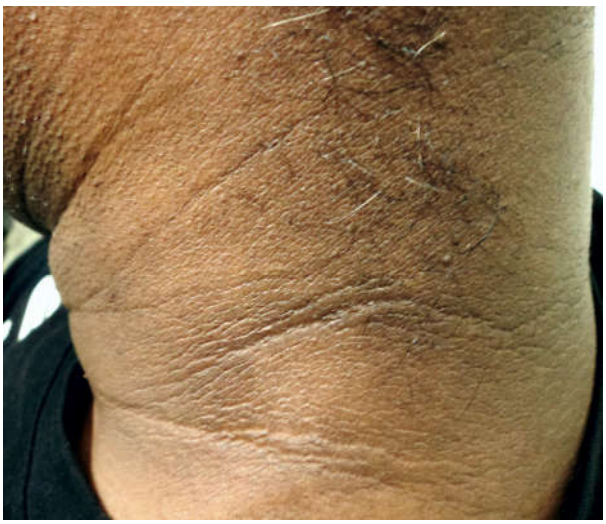

Fig: 8: Brown-colored hyperkeratotic coalescent velvety plaques of acanthosis nigricans with acrochordons over the neck of a 35-year old man with diabetes.

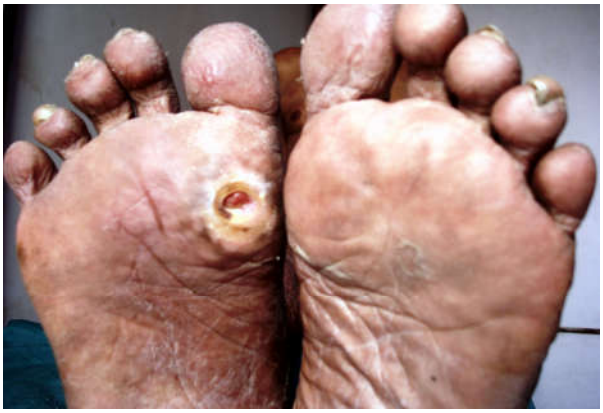

Fig: 9: Diabetic foot ulcer over the sole of a 50-year old man

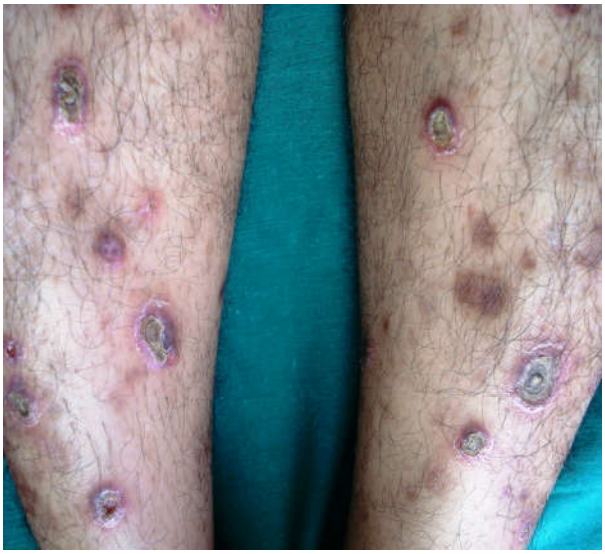

Fig. 10: Kyrle's disease; multiple perifollicular as well as interfollicular hyperkeratotic papules with adherent keratotic plugs over both legs, in a patient with type 2 diabetes mellitus with nephropathy

Discussion

Skin lesions in diabetes mellitus are sometimes a mirror to an underlying disease process and they may be the first expression of the disease. In the present study, 250 diabetics with cutaneous manifestations were included. The majority of the patients (53.2%) were over 50 years of age; a finding comparable to that of the study by Thomas George, who reported 68% of the study patients being above 40 years of age [7]. The gender difference with more men with DM and cutaneous manifestations observed in this study is also similar to the previously reported results[7]

In the present study, 66 patients i.e. 26.4% were obese. Bernstein reported an incidence of 39% in his study [8]. The present study failed to demonstrate obesity as a significant factor for developing diabetes mellitus.

Twenty-seven (10.8%) cases of pyodermas were found in this study. The incidence of bacterial infections reported in previous studies has ranged from 14-20% [7,9]. It has been suggested that examination of the urine and blood for sugar should be carried out in all patients who have recurrent or chronic bacterial skin infections. Similar to the findings of this study, Greenwood *et al* also reported a high incidence of staphylococcal skin infections among diabetic patients [10]. Although recurrent folliculitis and furunculosis are indicators of diabetes, carbuncles are highly suggestive. The largest group of cutaneous disorders in the present study was constituted by fungal infections, detected in 65 patients (26%) with dermatophytosis in 17.6%, and candidiasis in 5.6%. Similarly high incidence of mycoses has been previously reported with dermatophytosis constituting 30-40% of the total cutaneous disease burden in diabetics [7,10]. A predominance of foot involvement and affliction of intertriginous regions has been reported [10]. Whether diabetes mellitus plays a role in the dermatophyte infection is remains debatable. While Rothman Kohn found no such association, in a relatively more recent study by Jolly *et al* involving 29 consecutive patients with recurrent *Trichophyton rubrum* infections, a significant proportion had elevated glucose tolerance curves [11,12].

The incidence of candidal infections was found to be lower in this study (6%) compared to higher rates reported by other workers. Mucocutaneous candidaisis was found in 14% cases in the study of Thomas George [7]. Anand reported that 25% of the patients with candidial intertrigo had diabetes mellitus [9]. Hence a prompt search should be made for the presence of diabetes mellitus in non-pregnant females who have vulval pruritus and elderly men with balanoposthitis. Further, the high success rate in the detection of fungus by microscopy of KOH mount observed in this study reaffirms the importance of 10% KOH preparation as a simple and reliable tool for this purpose in diabetic patients.

The incidence of viral infections in the current study was low. A high incidence of association between herpes zoster and DM has been previously reported. Calandra and Lissi reported 52.9% of the patients with zoster had diabetes mellitus [13]. Sezia *et al* found 3.9% of the patients with diabetes developed herpes zoster [14]. Although, in the present study, patients with post herpetic neuralgia (PHN) were not encountered, the risk of PHN and other complications of zoster is well known to be higher in diabetics and seems to be dependent on the

extent of glycemic control [15].

Lichen planus has been reported to be associated with diabetes. In the study of Thomas George, 2% patients of DM had extensive lichen planus [7]. Abnormal glucose tolerance test (GTT) has been reported in 36-80% cases with LP [16-18]. In the present study, 16 cases of DM (6.4%) had psoriasis vulgaris. Anand and Aschner *et al* reported DM in 8.88% and 5.7% of psoriasis patients respectively [9,19]. The association of psoriasis with diabetes mellitus remains controversial. While Lynch showed no more than chance association between psoriasis and diabetes, others have reported strong association between the two [20-22]. Hajini *et al* and Pranesh Nigam *et al*, reported abnormal GTT in 14.3% and 27.7% of psoriasis patients respectively [21,22].

In this study, AN was detected in 2.4% of the diabetic patients. AN is a well-established cutaneous marker of the metabolic syndrome, which is characterized by insulin resistance. In the PRIME Net study of Kong *et al*, the rate of AN was 22% among those with significant risk factors for T2DM.

Further, patients with AN were twice as likely as those without AN to have type 2 diabetes (35.4% vs 17.6%; P < .001) [23]. The incidence of acrochordons found in the current study was much lower than other studies. The reported percentage of patients with multiple skin tags having DM has ranged upto 72.3% [24].

Autoimmune disorders like vitiligo and alopecia areata have a plausible association with diabetes. Late onset vitiligo after the age of 40 years appears to have a close association with diabetes mellitus. Dawber reported 4.8% patients of maturity onset of diabetes mellitus to have concomitant vitiligo [25]. While there is a paucity of specific studies linking these alopecia areata with DM, their association may be explained by the common autoimmune etiology of both disorders. Although the incidence of lichen amyloidosis in diabetic patients was observed to be low (1.6%) in this study, higher incidence has been reported by others like Weyers *et al* [26]. They attributed generalized pruritus to be the causative factors for lichen amyloidosis in diabetics. Similarly, although we found just 3 cases of rosacea in the study population, the association of rubeosis faciei (red face) and diabetics has been reported to be strong. Paron and Lambert reported upto 59% of patients with "red face" to be diabetics [27].

The association of acquired perforating dermatosis (APD) including Kyrle's disease with DM and related or unrelated renal and/or hepatic insufficiency is well known. In their study of 25 patients with APD, Akoglu *et al* reported that diabetes constituted the highest risk for the development of APD (48%), although only one of the 25 patients had Kyrle's disease [28]. Further, owing to the presence of concomitant systemic morbidities in patients with Kyrle's disease, a direct link between diabetic nephropathy and Kyrle's disease warrants further substantial investigations.

In the present study, 13 cases (5.2%) of diabetic ulcer of foot were encountered in longstanding patients with T2DM. The ulcers were present at the sites of high mechanical pressure on the plantar surface of feet. A new term, diabetic foot disease (DFD) better describes the spectrum of feet complications arising from complications of diabetes. DFD occurs in all types of diabetes showing higher prevalence among males and in patients more than 60 years old [29]. The lifetime risk for the development of a diabetic foot ulcer in patients with diabetes ranges from 15% to as high as 25% [30,31]. The burden of diabetic foot disease (DFD) is expected to increase in the future. Diabetic peripheral neuropathy (DPN) is a major risk factor for foot ulceration. DPN leads to loss of protective sensation resulting in continuous unconscious traumas. Patient education and early detection of high risk foot are essential for the prevention of foot ulceration and amputation [29].

Diabetic stiff hand syndrome, also known as diabetic cheiroarthropathy, is a disorder in which finger joint mobility becomes restricted as the hands become waxy and thickened [32]. It has been described in both T1DM as well as T2DM. A single case of diabetic hand syndrome in a patient with T2DM was seen in this study. Collier *et al* reported the incidence of diabetic hand syndrome in patients with DM to be 4.2% [33]. Poor glycemic control-associated enhanced protein glycosylation resulting in collagen deposition has been postulated to be the main etiological factor behind this syndrome. Diabetic microangiopathy and neuropathy contribute additionally [34].

The cutaneous manifestations and complication of DM seem to be multifactorial in origin. Acute metabolic derangements, insulin resistance cascade, chronic degenerative afflictions, impaired ability to handle infection due to altered cell-mediated immunity, abnormal carbohydrate metabolism, formation of advanced glycosylation end (AGE) products, diabetic neuropathy and microangiopathy, and complications of anti-diabetic medications, all contribute to the pathogenesis of cutaneous as well as other systemic morbidity of diabetes mellitus [35]. Early detection of the disease, early recognition of cutaneous complications and timely intervention

hold the key to successful management of these patients.

Conclusion

The results and deductions from the current study suggest that patients with diabetes mellitus are highly susceptible to development of cutaneous infections, and must be closely monitored for the same for early treatment. By corollary, any individual with recurrent bacterial and/or fungal infections should be screened for DM. Although other disorders of dysregulated immunity such as psoriasis, lichen planus, vitiligo, alopecia areata etc. are frequently encountered in diabetics, they do not seem to pose a huge threat to the overall morbidity. Although, we did not detect any diabetes-specific cutaneous disorders like NLD, complications like foot ulcers were commonly encountered. Judicious use of investigations like KOH mount, gram staining, fungal culture, and skin biopsy can render diagnosis and treatment more prompt and definitive. The shortcomings of the study include, lack of correlation between the glycemic control and cutaneous manifestations, and non-monitoring of improvement of skin disorders with successful treatment.

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Case Report

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Keratosis Follicularis Spinulosa Decalvans: A Series of Three Cases in a Family

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Abstract

Keratosis follicularis spinulosa decalvans (KFSD) is a rare genodermatoses characterized by hyperkeratotic follicular papules on the scalp, with progressive cicatricial alopecia of the scalp, eyelashes, and eyebrows. Ocular involvement with photophobia and keratitis, and dental anomalies may also be seen. Due to the genetic and clinical heterogeneity of similar disorders, a definitive diagnosis of KFSD is often daunting. We report a case series from India of three siblings, including a young girl and her two elder brothers, all of whom had features consistent with KFSD. There morphological heterogeneity and differential diagnosis of the condition is also discussed.

Keywords: Keratosis Pilaris; Follicularis; Keratosis; Alopecia; Cicatricial.

Case Details

Case 1

A 14-year-old-girl (Proband) born out of first degree consanguineous marriage presented with complaints of loss of hair and spiny lesions on the scalp and eye brows since childhood. She recalled complete absence of hairs at birth and gradual appearance of sparsely distributed fine hairs over scalp with age. The spiny lesions on scalp and eyebrows were itchy, red and scaly. History of atopy and photophobia were absent. There was no history of similar complaints in the parents, although her brothers were detected to have similar skin lesions (*vide infra*). The child was stunted for her age. On cutaneous examination there was presence of erythematous hyperkeratotic papules associated with hypotrichosis, with fine, short, brittle hair, affecting the scalp, eyelashes and eyebrows with evidence of cicatricial alopecia at places, and presence of ichthyosis over the limbs [Figure 1]. Keratosis pilaris was noted on the extensor surfaces of the upper and lower extremities. There was no palmoplantar hyperkeratosis. Nails, teeth and genitalia were unremarkable. Trichoscopy revealed follicular keratosis with evidence of cicatricial alopecia, perifollicular scaling, and irregular eyelashes with scaling and erythema at the follicular base [Figure 2]. Two of the four brothers of the proband were also affected.

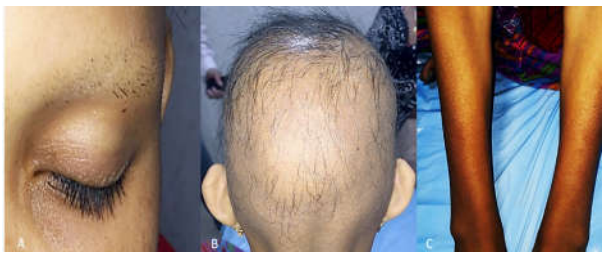

Fig. 1: Clinical features of the 14-year-old girl showing: **(A)** follicular papules with scaling and hypotrichosis of the eyebrows, **(B)** erythematous follicular hyperkeratosis over a background of sparse scalp hair, and **(C)** ichthyotic affection of the forearms

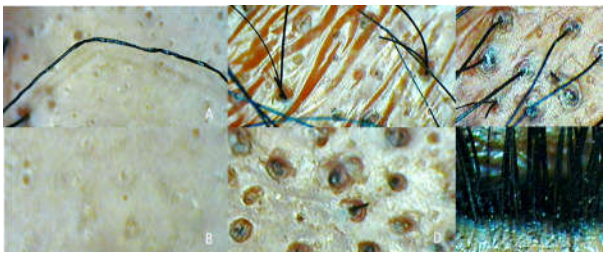

Fig. 2: Trichoscopic findings of the 14-year-old girl: **(A)** pigmented hair with wavy shaft suggestive of woolly hair, **(B)** cicatricial alopecia with loss of follicular orifices, **(C)** tufts of hair on the background of cicatricial alopecia, **(D)** follicular keratosis, **(E)** perifollicular scales, and **(F)** Irregular eyelash hairs with scaling at the base. (20 ×, non-polarized mode).

Case 2

The index patient's 22-year-old brother had similar complaints with sparse scalp, facial and body

hair, cicatricial alopecia of the scalp with hyperkeratosis, woolly hair and perifollicular scales, and ichthyosis [Figure 3]. Few follicular papules and minimal scarring alopecia were seen over the neck. Trichoscopy revealed wavy hair shafts suggestive of woolly hairs with loss of follicular orifices suggestive of scarring alopecia.

Case 3

The index patient's another 18-year-old brother had a similar history of absence of hair at birth with spontaneously regrowth at the age of 5 years. However, currently he has few patches of cicatricial alopecia over the scalp and sparse facial hairs, but with normal eyebrows, eyelashes, and body hairs.

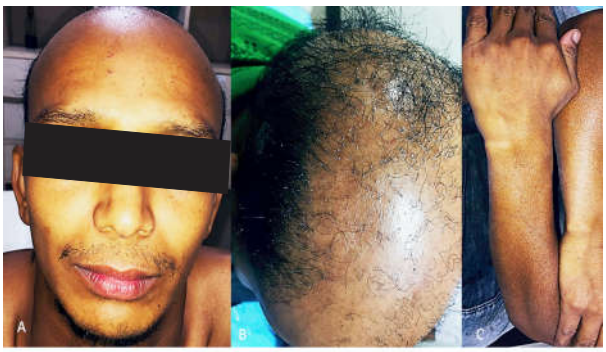

Fig. 3: Clinical features of the 22-year-old brother of the proband showing: **(A)** sparse scalp, facial hairs with irregular eyelashes, **(B)** perifollicular scaling and woolly hairs on background of cicatricial alopecia, and **(C)** ichthyosis on forearms

The constellation of clinical and trichoscopic findings in the patient, and her two brothers was consistent with a diagnosis of familial keratosis follicularis spinulosa decalvans (KFSD). Patients were offered scalp biopsy for histopathological confirmation but consent for the same was not obtained.

KFSD is one of several related disorders that are distinguished by the presence of keratosis pilaris with inflammation and subsequent atrophy. These disorders have been grouped under the category of keratosis pilaris atrophicans (KPA), which comprises keratosis pilaris atrophicans faciei, atrophoderma vermiculatum, and KFSD [1,2].

There are many sporadic cases, but the most intensive manifestations are found in men suggesting a pattern of X-linked pattern of inheritance. Rare instances of male-male transmission suggested the existence of an autosomal dominant transmission [3-6]. The suspected genetic locus has been traced to a mutation in MBTPS2 gene [6]. Phenotypic manifestations of KFSD are usually limited to skin, teeth, and eye. However, rare findings, including developmental delay, growth retardation, abnormal genitalia, and dysmorphic facies have been reported [5].

The overlap in clinical features between subtypes of scarring follicular keratoses can lead to misdiagnoses. While cicatricial alopecia of the scalp and eyebrows is a hallmark of the KFSD, other distinguished features of this disorder include. photophobia, widespread hyperkeratosis pilaris-like lesions, and teeth abnormalities.

The ichthyosis follicularis alopecia photophobia (IFAP) syndrome constitutes a close clinical differential of KFSD. IFAP is characterized by non-scarring alopecia, extensive keratosis pilaris, severe photophobia and corneal dystrophy [7]. The presence of scarring alopecia in our patients favoured the diagnosis of KFSD over the IFAP syndrome.

Although there is insufficient data and documentation with respect to the histopathological findings of scalp biopsy specimens of KFSD, a skin biopsy specimen may be sent for histological examination, including special stains for collagen and elastic fibers.

Histopathology helps to rule out other diseases in the differential diagnosis. The histological hallmark of KFSD appears to be compact hyperkeratosis and hypergranulosis of the upper follicular epithelium, indicating abnormal keratinization. There is follicular plugging and absence of hair shafts.

Treatment of KFSD is difficult and unsatisfactory. The aim of treatment is to stop the progression of the alopecia and clinical improvement of the areas that present with erythema and scaling.

Numerous treatments have been utilized, including topical and intralesional corticosteroids, topical and systemic antibiotics, dapsone, and systemic retinoids [8]. Despite follicular hyperkeratosis being an important component of the disorder, outcome of systemic retinoid therapy has been unsatisfactory.

Systemic isotretinoin therapy at a dosage of 1 mg/kg for 4 months caused slight to no improvement in 3 patients with KFSD and was associated with flaring-up of inflammation in one patient [9,10]. The relief induced by any treatment is at most temporary, followed by an almost imminent relapse upon discontinuation of the therapy. The current case series of the kindred of three siblings with KFSD has been reported to highlight the clinical and dermoscopic features of this rare genodermatosis.

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Case Report
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Role of APRP for A Successful Take of Split Skin Graft

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Abstract

Introduction: Autologous Platelet Rich Plasma (APRP) and its clinical applications have drastically evolved since its first use in an open heart surgery to avoid excessive blood transfusion [8].

It is being widely used in the field of plastic surgery and cosmetic medicine because of its wound healing properties [9,10].

Split skin grafts are mostly commonly performed resurfacing procedures in plastic surgery and it mainly depends on the wound bed for its take. We present a case report of 11year old female with post burn contracture right foot for which contracture release and split skin grafting with APRP application for augmenting the take was performed under GA.

Keywords: APRP; Split Skin Grafts; Post Burn Contracture.

Case Report

A 11 year old girl presented with a post burn extension contracture of right 3rd, 4th and 5th toes with subluxation of 5th toe metatarsophalyngeal joint. Patient was treated with radiofrequency assisted post burn contracture incision release with k wire fixation of 5th toe, leaving a raw area of 3cm x 5cm over right foot dorsum. 1ml of APRP was obtained by standard double centrifugation protocol using 5cc of patient's blood. APRP was sprayed topically over the raw area as well as injected into the wound margins. A split thickness skin graft was harvested from right thigh, placed over raw area and fixed with skin stapler. Check dressings revealed successful complete take of a graft without any graftloss or infection.

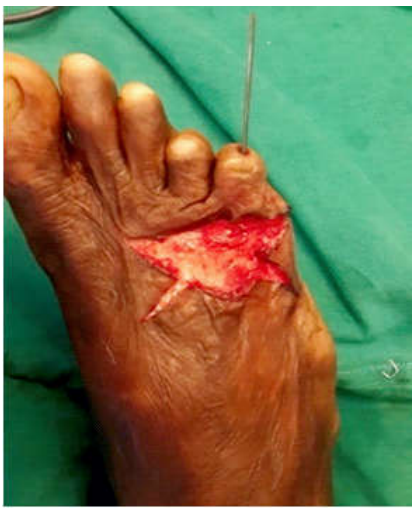

Fig. 1: Post Incision Release raw area of Post Burn Contracture Right foot

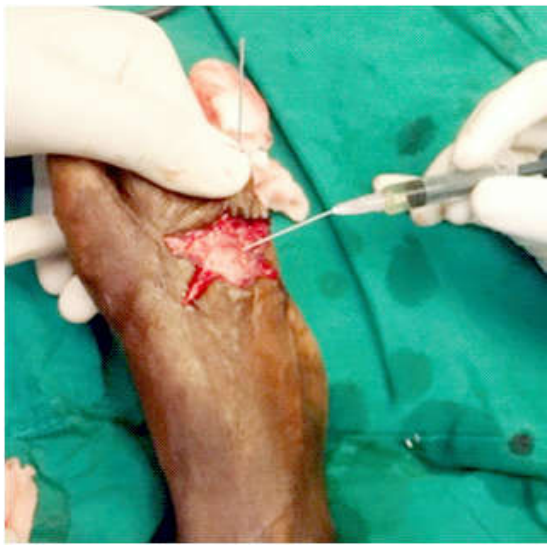

Fig. 2: APRP sprayed over raw area

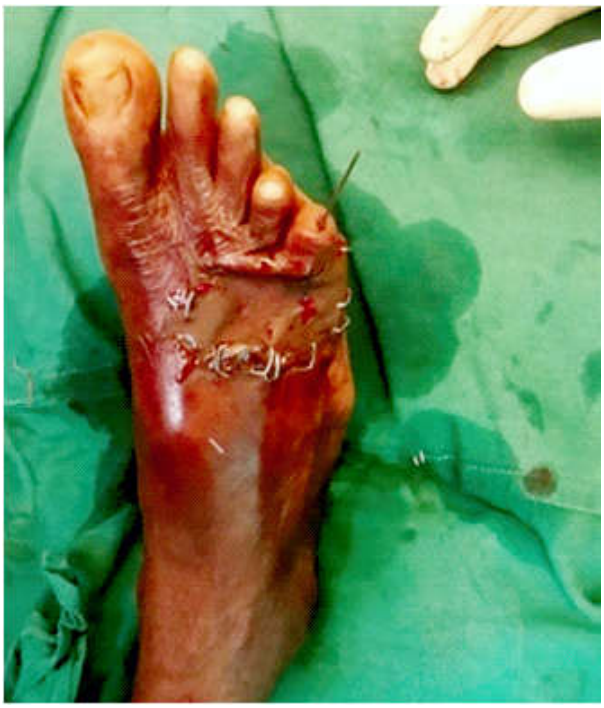

Fig. 3: SSG fixed over the raw area

Fig. 4: Complete take of SSG

Discussion

APRP is a blood plasma enriched with platelets concentration>10,00,000/μL in 5 ml of plasma. It is rich source of growth factors and cytokines like platelet derived growth factor, transforming growth factor beta, fibroblast growth factor, insulin like growth factors, vascular endothelial growth factor, epidermal growth factor, interleukin 8, keratinocyte growth factor, connective tissue growth factor which aid in repair and wound healing [1-4]. It has been found to stimulate epithelial, epidermal and endothelial regeneration and angiogenesis, promote collagen synthesis, augment hemostasis, reduce dermal scarring, accelerate soft tissue, bone healing and remodeling [5,6].

Split Thickness skin grafting is one of the commonest procedures performed in plastic surgery. The process of take of the graft involves plasma imbibition, inosculation and revascularization. A successful take of a graft depends on wound bed vascular status, its micro-environment and adequate hemostasis [7].

APRP being rich in platelets augments the healing process by platelet plug formation, conversion of fibrinogen to fibrin which in-turn helps in adhesion of the skin graft to the wound bed and provides a stable fixation. This property of APRP aids in hemostasis preventing any collection underneath the graft. The growth factors from APRP promote angiogenesis and collagen deposition augmenting the take of the graft [7].

Conclusion

APRP is an autologous, easily available and easy to prepare, safe biological fluid with excellent wound healing properties which can be used to augment the take of split skin grafts. We suggest a large volume randomized controlled study be conducted to validate the routine use of APRP for augmenting take of split skin grafts.

Conflicts of Interest

Nil

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Case Report

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Collagen and Dermal Extract Scaffold: A Novel Cover for Burn Wounds Following Tangential Excision

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Abstract

Tangential excision and immediate cover of the wound with split skin graft forms the gold standard for treatment of deep burns. However split skin grafting has its own disadvantages.

Donor area may not be available in patients with extensive burns. Split skin grafts contract, provide poor cosmetic appearance and functional outcome. Due to advances in biological and cellular engineering many substitutes have been developed. However most of these substitutes are expensive and may not be applicable for routine use in our population. In this article we have described a novel method for cover of wounds after tangential excision in the form of collagen and dermal extract scaffold. This scaffold is safe, easy to prepare, inexpensive and effective in the management of post tangential excision raw areas.

Keywords: Tangential excision; Dermal Extract Scaffold.

Introduction

The ultimate goal in any thermally injured patient is the early closure or coverage of the burns wound. It reduces the morbidity and improves the functional outcome of the patient [1]. The concept of early excision of the burn wound was pioneered by Cope et al. Excision and grafting has become the standard of care all over the world for deep burns [2]. The purpose of early excision and grafting is to remove all dead devitalised tissue from the body and to render the wound bed amenable to cover with skin graft [3-5].

One of the main disadvantages of tangential excision is substantial intraoperative blood loss both from the excision site and from the skin graft donor site [6-9]. When the patient is still unstable, harvesting split thickness grafts can lead to more blood loss and cause deterioration of the general condition of the patient. In such cases, heterografting of the excised bed can be done. Collagen sheets can be applied after tangential excision. Collagen creates the most physiological interface between the wound and the environment [10]. It forms an impermeable layer and acts as a barrier to bacterial invasion. In addition it is natural, non-immunogenic, nonpyrogenic, hypo-allergenic, and pain-free [11-12]. Though collagen acts as a temporary cover till a more permanent cover in the form of split thickness grafting can be done, it takes a long time to cause epithelisation of the wound.

In this article we would like to highlight the use of a novel scaffold of collagen with dermal extract for cover of the wound bed after tangential excision in a patient with 35% accidental thermal burns.

Case Report

A 35 year old male patient presented to the JIPMER Tertiary Care Burns Centre with history of accidental thermal burns over both forearms, hands, legs and feet. On admission, the patient was stabilised according to the ATLS protocol and IV fluid resuscitation was started according to the Parkland formula. Once, the patient was stabilised, the wounds were assessed. It was noted that the patient had second degree deep thermal burns over forearms, hands and legs (Figure 1). On post burn day 2, the patient was taken up for early tangential excision. Tangential excision was done over the right forearm

(Figure 2). After excision of the necrotic tissue adrenaline saline soaked gauze was placed on the wound to control the bleeding. Once the bleeding from the wound bed was arrested, a scaffold made of collagen and dermal extract was placed on the wound.

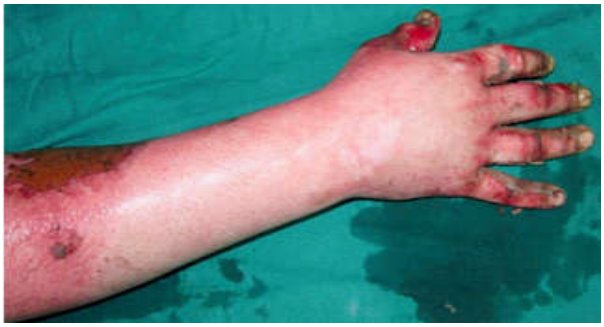

Fig. 1: Deep burns over the right forearm

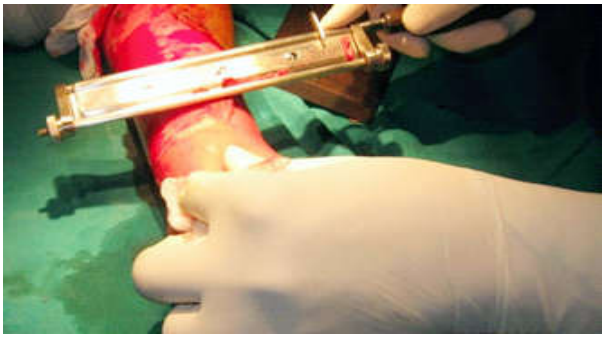

Fig. 2: Tangential excision being carried out

Preparation of collagen and dermal extract scaffold (Figures 3 -5).

Step 1: Informed consent is taken.

Step 2: The site for dermal graft harvest was chosen. One of the following sites was chosen for harvest of dermis – groin, popliteal crease or inferior abdominal skin.

Step 3: Sterile preparation of the surgical site was done and 1% solution of lignocaine mixed with adrenaline was infiltrated in the line of incision.

Step 4: Using a motorized diamond burr, the epidermis over the site of dermis harvest was removed by dermabrasion.

Step 5: Using a surgical scalpel, an incision over the dermis was made and the dermis elevated from the underlying subcutaneous tissue. Any excess subcutaneous tissue stuck to the under surface of the harvested dermis was removed.

Step 6: the donor site was closed primarily.

Step 6: The harvested dermis was minced into tiny pieces using an 11 number surgical blade.

Step 7: A mallet was used to crush the dermal pieces and further increase the surface area of the dermal extract.

Step 8: The dermal extract was spread out over a collagen sheet.

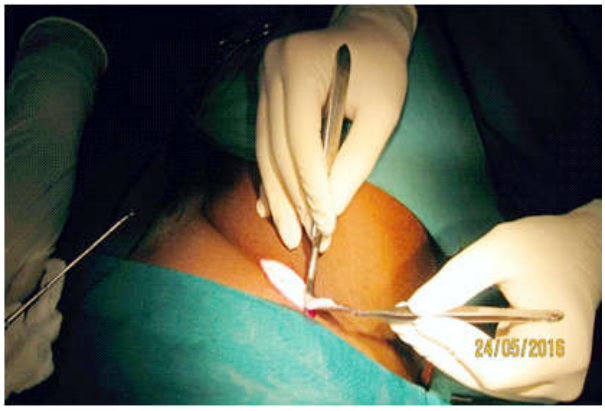

Fig. 3a: Dermis being harvested from groin region

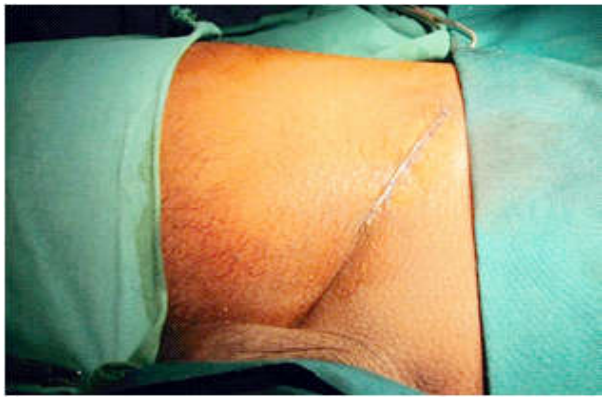

Fig. 3b: Wound closed primarily

Fig. 4: Prepared dermal extract

Fig. 5: dermal extract placed over collagen sheet to create a scaffold

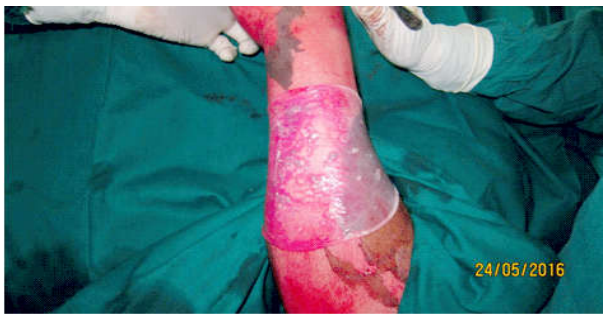

Fig. 6: Collagen and dermal extract scaffold placed on post excision raw area.

The prepared collagen and dermal extract scaffold was placed on the wound and sterile dressing was applied on top (Figure 6). The first postoperative dressing was done on post op day seven. When the wound was opened, it was found that the wound had contracted and epithelial islands had developed on the wound. Regular dressings were done with collagen and the patient was discharged after 25 days of admission without the need for skin graft (Figure 7). Patient was followed up for 1 month. All wounds were healed well without hypertrophic scar formation or wound breakdown.

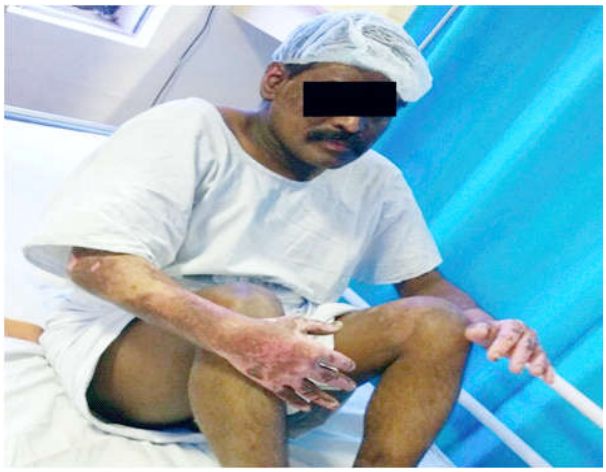

Fig. 7: Picture showing well healed wounds

Discussion

Autologous split thickness skin grafting is the gold standard for treatment following tangential excision. However donor area may not always be available. In addition, sometimes split thickness skin graft can give a poor functional outcome with poor cosmesis[13]. Therefore, to overcome this issue, in the past decade research has been conducted on the use of artificial epithelial and dermal substitutes.

An ideal substitute should have the following characteristics [14].

1. Inexpensive
2. analgesic,
3. Have a long shelf life
4. can be used off the shelf,
5. nonantigenic
6. Durable
7. Flexible
8. Prevents water loss
9. Antimicrobial
10. Conforms to irregular wounds.
11. Can be applied in a single sitting.

Various skin substitutes have been tried and tested for application in burns like honey, collagen, biobrane, transcyte, epicel etc. each with their own advantages and disadvantages.

The advantages that collagen has over the other biological substitutes is the ease of availability in various sizes, ease of removal, inexpensive, hypoallergenic, pain free, ability to store for around three years and the ability to incorporate drugs and growth factors which can be released in a controlled manner[1].

Lynch et al [15] used dermal autograft in tissue expander breast reconstruction. The structurally intact matrix of dermal autograft served as a scaffold that maybe necessary for tissue ingrowth and angiogenesis. Many studies have utilized acellular dermal tissue matrix or cultured human dermis for the treatment of diabetic ulcers [16-18]. The advantages of using autologous dermis as a means of wound bed preparation are plenty. Firstly, it can be performed under local anesthesia as a day care procedure. The donor sites can be closed primarily, leaving behind minimal scars. The dermal tissue that is harvested is autologous thus preventing any antigenic reaction and inflammation as occurs with allogenic dermal matrix [14].

Thus by combining the advantages of collagen and dermal extract in the same patient problems such as limited availability of donor area, use of heterogenous material for wound cover, cost etc can be overcome easily.

Conclusion

Biological skin substitutes like collagen have been used regularly for wound cover after tangential excision. Through this article we would like to advocate the use of collagen along with dermal

extract as a scaffold for wound cover after tangential excision. It is not only easily available and easily prepared but it is a highly effective method to induce early epithelisation in post tangential excision raw areas, avoiding the need for an additional procedure like split skin grafting.

Conflicts of Interest

None

Source of Funding

None

Disclosures

None

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