

BURNS AND DIABETES

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SUMMARY. Diabetes is often considered a risk factor for poor wound healing and increased complication rates for plastic surgery procedures. Burn injury in diabetic patients may have implications for the length of stay and number of operations required. We therefore we examined the characteristics of diabetic patients admitted to our burn unit and the impact of their condition on their hospital course. Charts of all patients with diabetes admitted to the burn unit from 1995 to 2000 were reviewed (n = 73). Demographic data, percent body surface area burned, anatomical location of the burn, number of surgical procedures required, length and cost of stay, and outcome were noted. The control population included 150 consecutive patients without diabetes treated during the same period. Diabetic patients were older and underwent a higher number of surgical procedures, with increased length of stay and increased mortality, despite an equivalent body surface area burned. They had a higher incidence of scald burns in the lower extremities than the non-diabetic population. This work shows that diabetic patients constitute a unique group. They are significantly older, have an increased rate of surgical interventions, increased hospital stay, and significantly increased mortality compared to a control group with similar surface area burns. This group is also more likely to have scald burns in the lower extremities, mostly due to diabetic neuropathy. This work emphasizes the importance of education and prevention programmes directed

Introduction

Diabetic patients are a special group of patients, known to have an increased risk of wound complications, such as infection and delayed healing. In burn patients, diabetes may have implications for length of hospitalization, hospital course, number of surgical procedures, and burn outcome. A retrospective study was designed in order to identify burn characteristics in diabetic patients admitted to our burn unit, and the impact of diabetes on their hospital course and outcome.

Materials and methods

The medical records of patients admitted to the Baltimore Regional Burn Center between 1995 and 2000 were reviewed, and 73 diabetic patients were identified. Diabetes was diagnosed by the primary care physician prior to hospitalization. The data collected included epidemiological information, total body surface area (TBSA) affected by the injury, anatomical location of the burn, cause of the burn, number of surgical procedures required, length and cost of hospital stay, and mortality. One hundred and fifty consecutive patients without diabetes, treated during the same time period, served as the control population.

Results

Our diabetic group consisted of 73 patients (45 males

and 28 females). Diabetic patients were older than the control population, with a mean age of 60 yr opposed to 32 yr ($p < 0.001$) (Table I).

Table I - Description of patients

	Diabetic (%)	Control (%)	<i>p</i>
Age (yr)	60.6 ± 1.83	32.7 ± 1.8	< 0.001
Female	28 (38.3%)	54 (36%)	NS
Male	45 (61.6%)	96 (64%)	NS
AA	28 (38.3%)	54 (36%)	NS
White	42 (57.5%)	85 (56.6%)	NS

AA = Afro-American

NS = Not significant

The aetiologies of the burns included scalds and flame burns. Scald burns were significantly more common in the diabetic population than in the control group (48% as opposed to 32%, ($p < 0.02$) (Table II).

Table II - Aetiology of burn injuries

	Diabetics	Control	<i>p</i>
Scald burn	35 (48%)	48 (32%)	< 0.02
Flame burn	33 (45.2%)	85 (56.6%)	NS

TBSA was not significantly different between the two groups (Table III). In the group of diabetic patients, 59% had burns in the lower extremities, as opposed to 44% ($p < 0.05$). Moreover, one-third of the diabetic patients had isolated lower limb burns (32.8%) compared to the control group (15.3%, $p < 0.05$) and a higher prevalence of head and neck involvement (87% as opposed to 30.6%, $p < 0.05$). On the other hand, the diabetic patients had a lower frequency of both upper extremity burns (45.2% as opposed to 57.3%, $p < 0.05$) and trunk burns (26% as opposed to 42.6%, $p < 0.05$) (Table III).

Table III - Burn site

	Diabetes (%)	Control (%)	<i>p</i>
TBSA	11.87 ± 2.19	8.69 ± 0.78	NS
Lower extremity	43 (59%)	66 (44%)	$p < 0.05$
Upper extremity	33 (45.2%)	86 (57.3%)	$p < 0.05$
Trunk	19 (26%)	64 (42.6%)	$p < 0.05$
Head and neck	27 (37%)	46 (30.6%)	$p < 0.05$
Isolated lower extremity	24 (32.8%)	23 (15.3%)	$p < 0.05$
Isolated upper extremity	2 (2.7%)	21 (14%)	$p < 0.05$

Although the diabetic group of patients had a similar surface area of burn to that of the control population, more surgical interventions were required. Fifty-three of the 73 diabetic patients underwent surgery (72.6%), while only 48 of the 150 patients in the control group had surgery (32%, $p < 0.01$) (Table IV). The hospitalization period was twice as long in the diabetic patients - 17 days, as opposed to less than 9 days in the control patients ($p < 0.001$). Ten diabetic patients (13.7%) had fatal burns, a fivefold higher ratio than the fatal burns ratio in the general population (2.6%, $p < 0.003$). As expected from these data, hospitalization costs were significantly higher in this group (74% higher) (Table IV).

Table IV - Patient outcome

	Diabetic (%)	Control (%)	<i>p</i>
Length of hospital stay (days)	17.15 ± 2	8.89 ± 0.99	< 0.001
Operations (n. procedures)	53 (72.6%)	48 (32%)	< 0.001
Deaths	10 (13.7%)	4 (2.6%)	< 0.003
Cost (\$)	36804 ± 6273	21158 ± 4063	< 0.038

Discussion and conclusion

This work was designed because we had already clinically observed that diabetic burn patients in our institution had different characteristics from those of non-diabetic burn patients. The control group was therefore not matched for age or other parameters of the patients.

Diabetic patients are usually complicated patients,

owing to the high prevalence of systemic microvascular damage affecting multiple organs. Also, peripheral neurological impairments are known to be predisposing factors for burn injuries, because of the decrease in protective sensation and tissue vascularity.¹⁻⁷ Frequent exposure of the lower extremities to hot liquids or objects during diabetic self-care, in particular, increases the risk of lower extremity burns in this group of patients.⁵ Furthermore, diabetes mellitus is well known to be associated with decreased healing ability and increased susceptibility to infection. Diabetes in burn patients may therefore have implications for the number of surgical procedures required, the complications rate, and length of stay.

This work shows that diabetic patients are a unique group of patients as they are significantly older than the general population admitted to the burn unit. Although TBSA is not significantly different from that of controls, diabetic patients have an increased rate of surgical interventions, prolonged hospitalization length, and a significantly increased mortality rate. This group also has an increased prevalence of scald burns, especially in the lower extremities, and a significantly lower incidence of upper extremity and trunk burns.

Clinical handicaps including motor debility, immobilization, sensory deficits, and old age all increase the risk of sustaining thermal injury.⁸⁻¹² The ability to recognize a potential burn hazard is impaired by deficits in protective sensation, thereby increasing the duration of such harmful exposure. It has been suggested that sensory deprivation is an even more important risk factor for burn injury than motor loss.^{4,10}

The diabetic patient sustaining a burn injury requires special attention and meticulous monitoring for several reasons.

Firstly, the prevalence of lower extremity burns has its own particular implications. The lower extremity burns that characterize diabetic patients are unique in their aetiology, clinical course, and implications. Foot burns have been associated with increased incidence of infection, a prolonged hospital course and bed rest, and an increased need for skin grafting.¹¹ Some lower extremity burns in diabetic patients have been found to be readily preventable, especially those associated with individual home self-care. These patients are prone to prolonged immersion time in a hot bath or bathing in excessively hot water, owing to loss of protective sensation.⁴ Other burns have been shown to occur during the course of everyday domestic activities.⁴ All these factors explain the high frequency of isolated lower extremity burns in diabetic patients, compared to the general population. The low incidence of upper extremity burns in diabetics implies that these patients, as a group, are less active in manual tasks. Conversely, the high prevalence of upper extremity burns that distinguished the control group can be explained by the finding that approximately one-third of these patients were victims of work-related industrial accidents, as reported by Ng et al.¹³

Secondly, the typical diabetic patient suffering from burns is more than 50 years old, which is a known risk factor for increased morbidity and mortality from burn injury, partly because older patients often have associated co-morbidities.

Thirdly, the combination of poor wound healing and an altered immune system increases susceptibility to burn wound infection, cellulitis, and sepsis in the diabetic population. Prolonged wound healing is due to a combination of decreased vascularity, peripheral neuropathy, old age, reduced immunological defences, and other cellular, metabolic, and biochemical factors.¹⁴

Fourthly, when a major burn injury occurs in a patient with diabetes, it aggravates the inherent tendency to insulin resistance, necessitating meticulous glucose monitoring and insulin treatment.⁷

Owing to the characteristic high complication and mor-

tality rates among burned diabetic patients, primary prevention strategies are extremely important. Supervision while bathing, the use of a water thermometer, and the testing of water with a fully sensitive body part are basic recommendations for the diabetic patient. We also recommend avoiding the use of contact warming devices such as heaters and hot packs. Further emphasis should be placed on the special obligatory hospital care of these patients. As said, these complicated patients need careful clinical and laboratory monitoring, with a high index of suspicion against local or systemic infection. Surgical treatment should be meticulous and definitive.

With the emphasis today on prevention and cost-effective treatment, the aetiology and anatomical location of burns in diabetic patients indicate that preventive measures could help to reduce the frequency and severity of burn injuries.

RÉSUMÉ. Le diabète est considéré un facteur de risque pour une guérison médiocre des lésions et pour un taux augmenté de complications dans les procédures de chirurgie plastique. Les brûlures chez les patients diabétiques peuvent avoir des implications pour ce qui concerne la durée de l'hospitalisation et le numéro d'opérations chirurgicales nécessaires. Les Auteurs ont examiné les caractéristiques des patients diabétiques hospitalisés dans leur unité de brûlés et l'effet de leur condition sur le décours hospitalier. Ils ont examiné les fichiers cliniques de tous les patients atteints de diabète hospitalisés dans leur centre de brûlés dans la période 1995-2000 (n = 73) et ils ont noté les données démographiques, le pourcentage de la surface corporelle brûlée, la zone anatomique de la brûlure, le numéro d'opérations chirurgicales nécessaires, la durée et le coût de l'hospitalisation, comme aussi et le résultat final. La population témoin était composée de 150 patients consécutifs sans diabète traités pendant la même période. Les patients diabétiques étaient plus âgés et ils ont subi un numéro plus élevé d'opérations chirurgicales, avec une hospitalisation plus prolongée et une mortalité augmentée, malgré la surface corporelle brûlée équivalente. Ils présentaient une incidence majeure de brûlures dues à l'ébouillement aux extrémités inférieures par rapport à la population non-diabétique. Les Auteurs démontrent que les patients diabétiques constituent un groupe particulier: ils sont plus âgés en manière significative, ils subissent un numéro majeur d'interventions chirurgicales, leur période d'hospitalisation est plus prolongée et la mortalité est majeure en manière significative par rapport à un groupe témoin atteint de brûlures d'extension comparable. Ce groupe de patients est en outre plus exposé au risque de brûlures aux membres inférieurs dues à l'ébouillement, principalement à cause de la neuropathie diabétique. Les Auteurs soulignent l'importance des programmes d'éducation et de prévention créés pour ce group particulier de patients afin de réduire la morbidité, la mortalité et le coût de l'hospitalisation.

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