

ORIGINAL ARTICLE

Effect of total contact cast in non-healing diabetic foot ulcers in Lebanese patients

Marie Merheb, Elie Gharios, Alaa Younes, Mohamad Al Cheikh & Toufic Chaaban

Department of Endocrinology, Mount Lebanon Hospital, Hazmieh, Lebanon

Key words

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Correspondence to

Dr Marie Merheb, MD, AACP, MBA
Department of Endocrinology
Mount Lebanon Hospital
Gharios Medical Center
Blvd. Camille Chamoun
Hazmieh, Lebanon
E-mail: marie.merheb@mlh.com.lb

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Abstract

The aim of this study was to evaluate the effectiveness of total contact casting (TCC) in treating non-healing diabetic foot ulcers in Lebanese diabetic patients. Twenty-three diabetic patients were treated with TCC, and relevant data were collected retrospectively. Sixteen patients were analysed; the average duration of casting was 6 weeks, and 75% of the patients achieved complete ulcer closure without recurrence during one year of follow-up and without any complications. TCC appears to be an effective treatment of diabetic foot ulcers.

Introduction

Diabetes mellitus (DM) is a group of metabolic disorders that share the phenotype of chronic hyperglycaemia resulting from defects in insulin secretion, insulin action or both. Currently, 347 million people worldwide have diabetes; more than 80% of people with diabetes live in low-and middle-income countries (1). In particular, the Middle East and North African region has the highest prevalence of diabetes with around 11%; 34.2 million people live with diabetes (2). The World Health Organization (WHO) projects that diabetes mortalities will double between 2005 and 2030 (3).

As per the fifth edition of the International Diabetes Federation (IDF) atlas of 2011, 20.2% of the Lebanese population has diabetes, causing 4,525 mortalities in the same year (4). This raises the alarm for this epidemic in Lebanon and triggers prevention programmes to limit the extent of this disease.

The diagnosis of DM is based on blood glucose measurements and the presence or absence of symptoms (thirst, polyuria, weight loss, blurry vision), fasting plasma glucose (FPG) ≥ 126 mg/dl (7.0 mmol/L), glycated haemoglobin (HbA_{1c}) $\geq 6.5\%$ (48 mmol/mol), a 2-hour value in oral glucose tolerance test (OGTT) ≥ 200 mg/dl (11.1 mmol/L) or a random plasma glucose concentration ≥ 200 mg/dl (11.1 mmol/L) in the presence of symptoms.

Screening is recommended for all individuals aged older 45 years every 3 years and at an earlier age if they are overweight [body mass index (BMI) >25 kg/m²] and have one additional risk factor for diabetes. Risk factors include family history, obesity, physical inactivity, race/ethnicity, previously identified with impaired fasting glucose, impaired tolerance test or an

HbA_{1c} of 5.7–6.4%, hypertension, abnormal lipid panel profile, polycystic ovary syndrome or *acanthosis nigricans* and history of cardiovascular disease.

The major increase in mortality among diabetic patients, observed over the past 20 years, is considered to be because of the development of macro- and microvascular complications, including failure of the wound-healing process. Particularly, diabetic foot ulceration (DFU) is probably the major complication of the diabetic foot; 15% of diabetic patients are estimated to develop a foot ulcer during their lifetime and precede 84% of all lower leg amputations (5). DFUs occur in 1.3–4.8% in the community, in as high as 12% in hospitalised patients (6). This represents considerable patient morbidity and is related to substantial health care costs.

Key Messages

- of the Lebanese population, 20.2% have diabetes, causing 4,525 deaths in 2011
- total contact casts may reduce or eliminate pressure in the region of the ulcer
- the effectiveness of total contact casting in treating non-healing diabetic foot ulcers is evaluated in Lebanese diabetic patients
- diabetic foot ulceration is probably the major complication of the diabetic foot
- total contact casting appears to be an effective treatment of diabetic foot ulcer

Table 1 Baseline characteristics of all patients

Patients number	Age (years)	Gender (M/F)	HBA1c (%)	Retinopathy	PAD	Ischemic	Infection	Microalbuminuria	Outcome*
1	80	M	6.5	Yes	Yes	No	Yes	Yes	NH
2	56	M	7.4	Yes	Yes	No	Yes	Yes	CH
3	40	M	8.3	No	Yes	No	No	No	CH
4	73	M	9.3	No	Yes	Yes	Yes	No	CH
5	53	M	9.7	Yes	Yes	No	No	Yes	CH
6	57	M	6.9	No	Yes	No	No	Yes	CH
7	46	F	9.8	Yes	Yes	No	Yes	Yes	CH
8	53	F	7.5	No	No	No	Yes	No	NH
9	70	M	15.3	Yes	Yes	Yes	Yes	Yes	NH
10	79	M	8.6	No	Yes	No	Yes	No	CH
11	33	F	9.2	No	Yes	No	Yes	No	CH
12	61	M	13.2	No	Yes	No	No	Yes	CH
13	85	M	8.2	Yes	Yes	Yes	Yes	Yes	CH
14	50	M	11	Yes	Yes	Yes	Yes	Yes	NH
15	55	M	9.6	No	Yes	Yes	Yes	No	CH
16	60	M	8.3	Yes	Yes	Yes	Yes	No	CH

CH, complete healing; NH, non-healing; PAD: peripheral arterial disease.

*Outcome was defined as complete healing (CH) or non-healing (NH).

'Foot Clinics' and a multidisciplinary approach can reduce above-ankle amputations by 50–80% (7). Off-loading devices, including total contact casts (TTC), cast walkers, shoe modifications and other devices to assist in ambulation, are available to reduce or eliminate pressure in the region of the ulcer, which is important for healing. The evidence supports the use of TTC and non-removable cast walkers for relief of pressure associated with diabetic ulcer healing. Although TCC is considered the optimal method of management for neuropathic ulcers, it must be reapplied weekly and requires considerable experience to avoid iatrogenic lesions. Acceptable alternatives to TCC are removable walking braces and the 'half shoe'. A mainstay of ulcer therapy is debridement of all necrotic, callus and fibrous tissue. In this context, the purpose of this study was to evaluate the effectiveness of TCC in treating non-healing foot ulcers in a group of Lebanese diabetic patients and to describe the clinical outcome of such therapy in a single medical centre.

Methods and patient

The present study was observational and retrospective conducted, enrolling 23 Lebanese patients who were treated with a total contact cast at Mount Lebanon Hospital from 2000 to 2012.

Data were collected by chart review and direct phone interview. Data collected included age at casting, gender, type of diabetes, duration of the disease, the presence of neuropathy, retinopathy or peripheral vascular disease, ischaemic changes and any other complication of diabetes. Neuropathy was assessed by the presence of tingling, pain or loss of sensation as expressed by the patient. Peripheral vascular disease and retinopathy were based on the result of the documented physical findings in patients' charts. Complete ulcer closure or complete healing (CH) was defined as skin closure (100% re-epithelisation) after removal of the TCC without any complications or recurrence during the first year of follow-up. Recurrence of the ulcer during 1 year of follow-up or no closure of

the ulcer after the use of TCC was defined as non-spontaneous healing (NH). Such data was difficult to gather, and details were gathered by patients' or family member interview or by reviewing subsequent medical files for outcomes.

The patients waived their rights for information access and signed an informed consent form when they were admitted to the hospital. The verbal consent of the patient or the family member was also obtained by telephone.

Data were collected and analysed respecting the patients' confidentiality and anonymity.

Results

Complete data was found for 16 patients who were then included in the analysis. The mean age of the patients was 59 years, 81% were male. The mean duration of DM on casting was 12 years. The average HbA1c for this group was 9.3%, ranging from 6.5% to 15%. Of 16 patients, eight had retinopathy; almost 94% has peripheral vascular disease, and nine of 16 patients had microalbuminuria. Table 1 summarises the baseline characteristics of the patient sample.

Twelve of 16 (75%) ulcers were infected, and 50% were ischaemic at that point. The average duration of casting was 6 weeks, and no further details are available. Also, 75% of the patients achieved complete ulcer closure without recurrence during one year of follow-up and without any complications. The remainder did not heal well and required other intervention.

Out of the 12 patients who achieved complete ulcer closure, eight (67%) patients had previously been treated for infection, four (33%) for ischemia, five (42%) for retinopathy and six (50%) for microalbuminuria, and all had peripheral arterial disease. Four patients had a non-healing ulcer after the first cast was removed; two had a previously treated infection; three had peripheral arterial disease; two had ischaemic changes; and three had retinopathy and microalbuminuria. One of them experienced a secondary amputation during the same year of follow-up.

Discussion

TCC appears to be an effective treatment for DFU, and the result of our observational study reconfirms the effectiveness of TCC in promoting the healing of DFUs. The percentage of healing in our study after the use of TCC is 75%, a lower healing rate as compared to other studies, such as the study by Mueller *et al.* where the rates of ulcer healing was documented in 19 of 21 patients (91%) with TCC within 42 days on average (8). This can be explained by multiple factors. First, the majority of patients had peripheral arterial disease, and most of the ulcers were ischaemic, and the percentage of healing of ischaemic and infected ulcers is known to be lower than uncomplicated ulcers or purely neuropathic ulcers. Second, the difference in socioeconomic status and patients' education between our population and the western population may also contribute to this discrepancy.

Prevention of an initial or subsequent foot lesion is crucial to avoiding amputation. The best approach is to provide a multidisciplinary approach to foot care. As for treatment, the primary goal in the treatment of DFUs is to obtain wound closure. Management of the foot ulcer is largely determined by its severity and grade (9), vascularity and the presence of infection. A multidisciplinary approach should be employed because of the multifaceted nature of foot ulcers and the numerous comorbidities that can occur in these patients. This approach has demonstrated significant improvements in outcomes, including reduction in the incidence of major amputation. Rest, elevation of the affected foot and relief of pressure are essential components of treatment and should be initiated at first presentation. Ill-fitting footwear should be replaced with a postoperative shoe or another type of pressure-relieving footwear. Crutches or a wheelchair might also be recommended to totally off-load pressure from the foot.

Our study is limited by being a retrospective analysis of charts, and data collected over phone calls were incomplete on many occasions. Many of the patients have passed away

since the event of the foot ulcer, limiting the possibility to re-evaluate at the long-term follow-up. Assuming that the cast was applied for ulcers with any grade above 3 or 4, infection was cleared before cast placement. Finally, the absence of a standardised approach and a multidisciplinary team approach including podiatrists may have also contributed.

To conclude, more awareness of the morbidities associated with foot ulcers among patients and better education for primary care physicians, endocrinologists, orthopaedic and vascular surgeons in Lebanon are required for TCC to become standard of care for diabetic foot ulcers in Lebanon.

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