

CASE REPORT

Extremely accelerated healing of diabetic foot ulcers with Medical Nutrition Therapy: report of the first three cases

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Abstract

We hypothesized that improved nutrition could improve the healing of diabetic neuropathic ulcers. Using a diabetes specific nutritional formula we obtained healing in a very short time in the first three consecutive cases of unremitting ulcer of more than 90 days duration. Pressure ulcers of the feet are frequent in the neuropathic diabetic population and the healing is extremely slow and painstaking with frequent relapses and high costs.¹ Among the numerous reasons behind the slow reaction of the tissues is the wasting of the subcutaneous tissue and the dryness of the skin, partly explained by the catabolic state of uncompensated diabetes.

We hypothesized that improving nutrition might be useful. We decided to add a diabetes specific formula with high nutritional value (Glucerna@Select), 500 ml/day, enriched with 24 key vitamins and minerals, and 20% cal from protein, 49% from Fat (32.2% MUFA and 9.7% PUFA) and 31% slow release CHO in 3 consecutive diabetic subjects who had an unremitting neuropathic ulcer for > 3 months and were considered a failure. The subject were in acceptable metabolic control with HbA1c \leq 7.3%. All patients underwent a Body Bioimpedensiometric Analysis to measure the total body water (TBW) and its partition into intracellular (ICW) and extracellular (ECW) water before the start of Glucerna@Select and at the time of healing.

Keywords: Diabetic foot, ulcers, neuropathy

Case I

Male, 52 years old, with diabetes duration of 14 years, BMI=29 Kg/m². This subject had a circular ulcer under the head of the 3rd metatarsal bone of the right foot (Fig. Ia), 1.1 cm deep and 2 cm in diameter. The subject presented a reduced vibratory perception throughout the foot and the ultrasonogram of the lower limb arteries was normal. The ulcer had been followed at another Unit for 2 months, and at our Unit for the following 90 days. During this period the subject had been treated with immobilization, curettage, heparin, antibiotics and local medications without improvement. He was on glargine insulin at bedtime and 2 shots of rapid acting analog at mealtime. The mean of four HbA1c values for the preceding year was 7.2 ± 0.3 . On 07/26/ 2008, we started this subject on Glucerna@SR, 500 ml/day and on 07/31/08 we obtained the healing of the ulcer (Fig. Ib). The general aspect and the hydration of the foot improved. We also observed the redistribution of the ICW and the ECW. On 07/22/08 the TBW was 64.4 litres (61.3%), the ECW 27.5 litres (42.7), the ICW=36.9 (57.3%), on the 07/22/08 TBW=61.0 litres (58.1%), ECW=30.3 litres (49.6%), ICW=30.7 litres (50.4%).

Case II

Male, 61 years old, with diabetes duration of 22 years,

BMI=29 Kg/m², proliferative retinopathy and peripheral neuropathy with serious Charcot deformation, treated from February 2005 for a large ulcer of the left foot. The size of the ulcer was 12 x 8 cm with wasting of the subcutaneous tissue. During the 3 years of observation, a surgical repair was attempted 2 times but failed because of the poor quality of the subcutaneous tissue that did not permit the acceptance of the transplanted tissue. He was also treated with repeated periods of immobilization, topical hydrated fibers, 1 month period of hyperbaric oxygen, and intermittent antibiotics. The margins of the ulcer were resected every month and curetted at weekly intervals. On 07/22/2008, the aspect of the lesion was unhelpful (Fig. IIa). The HbA1c value for the preceding year was 6.9 ± 0.3 . He used glargine insulin at night and metformin 1000 mg tid at the main meals. On the 28th of July, the borders of the lesion were resected, and Glucerna@Select was started. On the 4th of August, the subcutaneous tissue was completely regrown and lively. Figure IIb represents the aspect of the lesion on 08/25/2008. On 07/28/08, the TBW was 39.5 litres (54.9%), the ECW 16.8 litres (42.5%), the ICW=22.7 (57.5%), on the 08/04/08 TBW=41 litres (57%), ECW=18.6 litres (45.4%), ICW=22.4 litres (54.6%). Also in this case, the treatment seemed to have normalized the fluid distribution between the IC and the EC compartments.

Case III

A 48-year old male with BMI=26 Kg/m². He had a severe Charcot deformation in the feet and the proximal end of the broken third tarsal bone was protruding from the anterior

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area of the left foot (Fig. IIIa). He was seen at our institution on October 2007 when a surgical repair was attempted with



Fig. 1a-25/07/2008

Fig. 1b, Subject I, 31/07/2008



Fig. 2a, subject II -22/7/2008 **Fig. 2b**, Subject II, 25/8/08



Fig. 3a, Subject III before surgical repair; **3b**, 15 days after surgical repair

removal of the protruding bone. However, the tissues did not heal and the ulcer was turned into a chronic wound. The therapy was continued with antibiotics, hydrated fiber, heparin, fat gauge, silver and talus shoe, and 2 more attempts at surgical repair failed. His therapy consisted of one injection of insulin glargine at bedtime and 2 shots of rapid acting analogue at the main meals. The mean of four determinations of his HbA1c was 7.1 ± 0.03 . He was operated one last time on 08/08/08 and on 08/10/2008 Glucerna select was started on a daily basis. Figure 3b shows the aspect of the lesion on 08/25/2008. In this case also there was a redistribution of the IC and EC water: on 08/06/08 the TBW was 32 litres (44 %), the ECW 14 litres (43.8%), the ICW=18 litres (56.3%), on 08/25/08 TBW=33 litres (43.5%), ECW=16 litres (48.5%), ICW=17 litres (51.5%).

In these subjects the time to healing was unexpectedly shortened when contrasted with the length of treatment

before the beginning of Glucerna@Select. In particular we were astonished by the rapidity of regrowth of the tissue and the transformation of a “ravished” tissue into a “vital” one. During the period of observation the blood glucose remained in stable control or improved.

Comments

The body of the uncontrolled diabetic subject is impoverished also due to the inappropriate neoglucogenesis subtracting the protein content. Furthermore, diabetics sometimes have disturbed absorption of some nutrients. These disturbances are further accentuated by their numerous inappropriate and frustrating attempts to dieting. Thus we speculated that the addiction of a nutritional formula widely used as Medical Nutrition therapy in the frail elderly might be useful in the diabetic subjects with foot ulcers. Unexpectedly the time to healing was extremely shortened.

Diabetic foot ulcers are an extremely complicated phenomenon with many different causes interacting simultaneously at many different levels. For each phase of the healing process, clotting, inflammation, proliferation, remodeling with collagen cross linking many factors have been implicated.^{2,3}

The blood glucose and the level of insulinization clearly have a role. Although many topical treatments are used, the results are far from satisfactory and in some cases may even be dangerous.⁴ Unfortunately to our knowledge the nutritional state has received scant attention. In our population with foot ulcers we consistently find abnormalities of hydration as demonstrated by the body impedensometric analysis, with a prevalence of intracellular water (intracellular edema). In the three cases described there was a prevalence of ICW that disappeared when the ulcer healed. This observation should be confirmed in other clinical settings.

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