

A Unique Way to Treat Charcot Foot with Non-Healing Ulcer Secondary to Morbid Obesity Related Uncontrolled Diabetes – A Case Report

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ABSTRACT

Introduction: Bariatric surgery provides an excellent tool of control for uncontrolled diabetes mellitus in morbid obesity patients. Its effects improve the micro and macrovascular morbidity; improve mortality and the overall quality of life. Despite improvements of the biomechanics marker, the neuropathy and foot deformity remain following surgery, which increases the risk of developing diabetic foot complications. This may be exacerbated by increased activity levels following dramatic weight loss.

Presenting Case: The current case study presents the case of a diabetic female patient suffering from morbid obesity. The patient has a Charcot foot presentation with non-healing planter ulcer due to high planter peak pressure complicated with osteomyelitis of the calcaneus bone. She underwent laparoscopy mini gastric bypass surgery for morbid obesity. Following the surgery her diabetes mellitus entered remission. Her ulcer showed significant improvements along with additional treatments such as debridement, adequate offloading, and multidisciplinary team management, plus a follow up as a surveillance program.

Conclusion: Diabetic foot is a complex disease, and the overall management of the situation is multidisciplinary to improve their morbidity and mortality, health care cost and the general improvement of the patient quality of life

Level of clinical evidence: 4

Keywords: Diabetic Foot, Bariatric Surgery, Obesity, Diabetic Foot Infection, Limb Salvable Surgery, Neuropathy, Foot Deformity

INTRODUCTION

Since 1980, the prevalence of obesity has doubled. Obesity is also recognized as one of the leading causes of type 2 diabetes^{1,2}. The World Health Organization (2013) reports that obesity and overweight will attribute up to 44% of cases of diabetes¹. Physiological functions of the body are adversely affected by obesity; it increases the risk of multiple diseases such as cardiovascular disease, diabetic mellitus and several types of cancer. These conditions well affect the quality of life, increase health care cost and increase mortality rate².

One of the complications of diabetes is foot ulceration, the annual incidence of diabetes foot ulcer is between 2-5%, and lifetime risks range from 15% - 20%³. Worldwide, the incidence of diabetic mellitus is increasing, and it will rise up to 366 million by 2030⁴. Neuropathy, peripheral arterial disease (PAD) and previous history of amputation or ulceration and foot deformity, have all been associated with the development of foot ulceration⁵. 85% of all amputations in diabetic patients is preceded by a foot ulceration which progress to a severe gangrene or infection⁶.

The international diabetes federation declared that its time in increase public awareness about diabetes and its foot complications because it affects socially, personally, medically and economically which all can be prevented. Foot lesion has adverse consequences on health care systems and health economics. The cost of diabetic foot ulcer DFU may vary with the interventions used to treat foot ulcer and management approach. In 2001, the US healthcare system records \$10.9 billion expenditure towards diabetic foot care managements and treatment⁷.

Alongside the risk factors mentioned earlier, obese people with diabetes have other factors that further increase risk of foot ulcer. An example is the shape of the foot and its functionality in the presence of obesity which has changed and where the gait pattern has been altered. Although obese people are often inactive, when weight bearing there are high planter peak pressure (PPP) on the foot than non-obese individuals, which contributes to increase risk of foot ulcer. The self-care in obese people effectively reduces as there is an inability of obese people to reach or view the planter surface of the foot and it also makes it not possible to get appropriate shoe size and to perfect shoe fitting. Furthermore, due to diabetic neuropathy, the pain signal is absent or reduced, and they will continue to mobilize on a foot subjected to potentially damaging trauma and potential ulceration^{1,5}.

Improved glycemic control reduces microvascular complication of diabetes, while weight loss is one of the approaches to improve and treat type 2 diabetes. This can be achieved by either a change of lifestyle, surgical approach or pharmacological or the combination of the approaches. Weight loss by bariatric surgery can be achieved by either malabsorption or restrictive surgery¹.

We present a novel approach; the treatment of diabetic foot, by bariatric surgery (sleeve gastrectomy / minim gastric bypass surgery). In a patient with chronic non healing ulcer over foot with Charcot joint and uncontrolled diabetes mellitus, bariatric surgery provided exceptional benefit. The reduction in weight and glycemic control allowed for decrease weight bearing, better healing of wound, and effective control of all infection and ultimately return of the foot to normal function. We noticed that, unfortunately, the neuropathic condition of the foot failed to improve in spite of other benefit.

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CASE STUDY

This case describes a 65-year-old female who was a known case of type 2 diabetes mellitus. She had previous history right below knee amputation, was a morbidly obese patient with BMI of 42.3, and left lower limb Charcot foot. She presented with left foot planter ulcer around the hind foot.

Initially she was managed with surgical debridement, offloading with removable (ankle high cast walker) and felted adhesive pad. The probe to bone was negative. Her ulcer improved and healed over 5-6 month then she was lost to follow up. Of particular note she had palpable peripheral pulsations but she was neuropathic with negative monofilament perception.

She presented after three months with recurrent ulcer over the hind foot, probe to bone was positive, and she was complaining of pain around the wound (Figure 1). She had other risk factors: poor family support, living alone with high activity (high pressure over left foot) and poor compliance to clinic visit.



Figure 1: Initial wound

Foot X-ray (Figure 2), MRI foot (Figure 3). The patient underwent surgical debridement of the ulcer and calcaneus bone, followed with negative pressure therapy and non-weight bearing (Figure 4). The PICC line (peripheral inserted central catheter) inserted for 6 weeks antibiotic (ceftriaxone) treatment grew pseudomonas. Initially the wound showed significant improvement but due to her weight and activity level her wound healing was slow (Figure 5). The Patient was advised to undergo bariatric surgery, considering all her comorbidities associated with obesity. She underwent laparoscopy mini gastric bypass surgery. Post-operative intentional weight loss contributed to good glycemic control and also decreased the pressure on her chronic non healing ulcer.



Figure 2: X-ray foot - Charcot foot with previous history debridement over the calcaneus with recurrent ulcer over the hind-foot



Figure 3: MRI foot: Heel ulcer with underlying oedema seen at the ulcer bed and also extensive oedema over the calcaneus with erosion of the planter aspect of the calcaneus



Figure 4: One month after debridement and negative pressure wound therapy



Figure 5: Wound after 2 months

Over 4-6 months, her blood sugar levels witnessed improvement, there was a reduction in peak planter pressure and all these factors contributed to the wound healing (Figure 6).



Figure 6: Wound after 4 months

Ironically, we found that her ulcer healing decelerated after a period. We believe that since the patient became more ambulatory secondary to weight loss, this had increased pressure on the ulcer (Figure 7). She was advised to reduce her activity and aggressive offloading with removable (knee high cast walker boot) and crutches healed the ulcer in the subsequent 8-10 months.



Figure 7: Wound after 8 months

DISCUSSION

Bariatric surgery showed significant improvements in diabetic control therefore, an improvement in mortality risk and their quality of life. In spite of the euglycemia, neuropathy, ischemia and foot deformity with remain following surgery which are risk factor for ulcer and Charcot neuroarthropathy. Continued podiatry and foot care education is crucial for these group of people to prevent diabetic foot complication^{1,5}.

When a patient is overweight, they are less active, and their peak planter pressure is high for short periods during weight bearing. However, when they lose weight following surgery, patient will become more ambulatory and the pressure, though lower, is more frequent and with their risk factors they are prone to trauma and foot ulceration. Obese people with limited physical activity can be osteopenia. Following bariatric surgery, they will have an increase bone turnover and decreased bone mass. With the mentioned risk factors of neuropathy, increase physical activity and decrease bone density, they are prone for repeat trauma to the foot which leads to the development of acute Charcot neuroarthropathy^{1,8,10}.

Dilemma: Obese people with diabetes are at a high risk of developing diabetic foot complications from ulcer, infection, gangrene, amputation and Acute Charcot Foot. Forementioned risk factors are neuropathy, deformity, and compliance with clinic visit, inactive patient, poor family support, and their inability to get proper footwear or ill-fitting footwear. These might hamper surgical results¹.

To tackle diabetes at an early stage before developing neuropathy or deformity, patients can consider bariatric surgery. This will improve the management of the chronic non healing ulcer and avoid complication of diabetes with micro-macrovascular implications. It will also improve further morbidity as patient is ulcer free and improve quality of life of these patients.

The treatment of diabetic foot is complex, and the disease management is multidisciplinary. Multiple specialties need to take part in the treatment. A good family support, patient complains to clinic visit and instructions, customized insole with orthotic and patient and family education are all necessary¹.

Any patient with diabetes should undergo foot risk evaluation prior to surgery as part of the surveillance program. It will provide us plan

Table 1: Describes diabetic foot risk stratification and triage, timeline for referral to foot specialist and follow up schedule¹¹.

Table 1 Time for a specialist? Mapping out a treatment and follow-up plan			
Priority	Indications	Timeline	Suggested follow up
Urgent (active pathology)	Open wound or ulcerative area with or without signs of infection New neuropathic pain or pain at rest Signs of active Charcot deformity (red, hot, swollen midfoot or ankle) Vascular compromise (sudden absence of DT/PT pulses or gangrene)	Immediate referral/consult	As determined by specialist
High (ADA risk category 3)	Presence of diabetes with a previous history of ulcer or lower extremity amputation Chronic venous insufficiency (skin colour change or temperature difference)	Immediate or 'next available' outpatient referral	Every 1-2 months
Moderate (ADA risk category 2)	Peripheral artery disease +/- LOPS DP/PT pulse diminished or absent Presence of swelling or oedema	Referral within 1-3 weeks (if not already receiving regular care)	Every 2-3 months
Low (ADA risk category 1)	LOPS +/- longstanding, non-changing deformity Patient requires prescriptive or accommodative footwear	Referral within 1 month	Every 4-6 months
Very low (ADA risk category 0)	No LOPS or peripheral artery disease Patient seeks education regarding foot care, athletic training, appropriate footwear, preventing injury, etc	Referral within 1-3 months	Annually as a minimum

*All patients with diabetes should be seen at least once a year by a foot specialist.
Key: ADA = American Diabetes Association; DP = dorsalis pedis; LOPS = loss of protective sensation; PT = posterior tibial

about follow up schedule, as they are at risk of future ulcer. Appropriate footwear and insole should be counselled as well.

RISK FACTOR FOR DIABETIC FOOT ULCER

Diabetic people with peripheral neuropathy, peripheral vascular disease, foot deformity and previous history of ulcer and amputation are at high risk to develop foot ulcers (Table 1). Related parameters are used as surveillances for screening patient who are at risk^{5,9}.

CONCLUSION

We find that bariatric surgery offers comprehensive benefits to patients with chronic non healing ulcers of diabetic foot with coexistent Charcot's joint. Such patients fare poorly in spite of best care provided. Uncontrolled diabetes, excessive and unequal weight bearing as well as osteoporosis and bone weakness seen in morbid obesity make healing difficult and challenging. When weight loss is rapid, intentional and permanent which is seen in bariatric surgery, the results are optimistic and allow for good healing of wounds with the reversal of diabetic foot complications. We encourage similar patients to undergo bariatric surgery and emphasize more research in this area. Also the adverse effects of increased mobility after significant weight loss increasing the rates of wounds in neuropathic diabetic feet need be further investigated.

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REFERENCES

1. Gooday C, Murchison R, Dhatariya K. Complex relationships requiring long-term follow-up: Obesity, bariatric surgery-induced diabetic remission and the diabetic foot. *Diab Foot J* 2014; 17: 20-4
2. Chooi YC, Ding C, Magkos F. The epidemiology of obesity. *Metabolism* 2019; 92:6-10.
3. Chun DI, Kim S, Kim J, et al. Epidemiology and Burden of Diabetic Foot Ulcer and Peripheral Arterial Disease in Korea. *J Clin Med* 2019;8(5):748.
4. Mariam TG, Alemayehu A, Tesfaye E, et al. Prevalence of Diabetic Foot Ulcer and Associated Factors among Adult Diabetic Patients Who Attend the Diabetic Follow-Up Clinic at the University of Gondar Referral Hospital, North West Ethiopia, 2016: Institutional-Based Cross-Sectional Study. *J Diabetes Res* 2017; 2879249.
5. Abbott CA, Carrington AL, Ashe H, et al. The North-West Diabetes Foot Care Study: incidence of, and risk factors for, new diabetic foot ulceration in a community-based patient cohort. *Diabet Med* 2002;19(5):377-84.
6. Zhang P, Lu J, Jing Y, et al. Global epidemiology of diabetic foot ulceration: a systematic review and meta-analysis. *Ann Med* 2017; 49(2):106-116.
7. Raghav A, Khan ZA, Labala RK, et al. Financial burden of diabetic foot ulcers to world: a progressive topic to discuss always. *Ther Adv Endocrinol Metab* 2018;9(1):29-31.
8. Rogers LC, Frykberg RG, Armstrong DG, et al. The Charcot foot in diabetes. *Diabetes Care* 2011; 34(9):2123-9.
9. Armstrong DG, Boulton AJM, Bus SA. Diabetic foot ulcers and their recurrence. *N Engl J Med* 2017; 376(24):2367-75.
10. Coates PS, Fernstrom JD, Fernstrom MH, et al. Gastric bypass surgery for morbid obesity leads to an increase in bone turnover and a decrease in bone mass. *J Clin Endocrinol Metab* 2004; 89(3):1061-5.
11. Harding K, Armstrong D, Chadwick P, et al. Local Management Of Diabetic Foot Ulcers Innovations in the management of DFUs and the diabetic foot in remission Living with a DFU: the patient's perspective Managing and treating DFUs. *World Union Wound Heal Soc*, 2017.