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Diabetes Update

Vol. 6 | Issue 52| 2025

Dear Doctor,

Greetings from Micro Labs Limited. We are happy to bring you "DIABETES UPDATE" which contains latest and interesting news in the field of Diabetes and Endocrinology.

- **Association of Anthropometric and Metabolic factors with high visceral fat in non-obese Diabetic Patients**
- **Association between continuous glucose monitoring-derived indicators and the risk of diabetic foot in type 2 diabetes mellitus**
- **Impact of a Circuit Training Program on changes in Myokines Levels in Insulin-Resistant Women**
- **Case Report on Diabetic ischemic ulcers with toe deformities**

Should you require any specific article or medical information, please feel free to contact us at medicalservices@microlabs.in

Looking forward to your valuable feedback

Best Regards,

Medical Team, Micro Labs Limited

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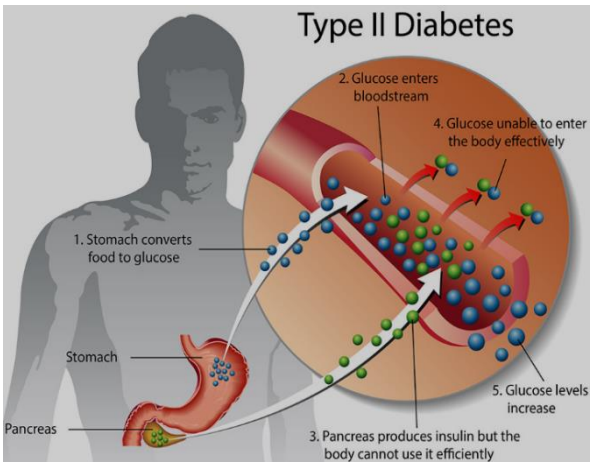
Diabetes Update

Vol. 6 | Issue 52| 2025

Association of Anthropometric and Metabolic factors with high visceral fat in non-obese Diabetic Patients

INTRODUCTION



TYPE 2 DIABETES MELLITUS

High VF in T2DM individuals with normal BMI can be predicted by NC and LAP.

Type 2 diabetes (T2DM) accounts for 96% of all occurrences of diabetes, and the prevalence of both obesity and diabetes is rising globally. In individuals with type 2 diabetes, cardiovascular disease (CVD) is the primary cause of morbidity and mortality.[1] The elevated risk of cardiovascular events in individuals with type 2 diabetes is directly associated with obesity. Additionally, visceral fat (VF) accumulation greatly raises the risk of CVD, making the distribution of adiposity in T2DM participants a crucial factor in determining CVD risk.[2] Asians with type 2 diabetes are known to have central obesity, namely an excessive build-up of VF. VF levels in T2DM subjects are generally greater than those in non-diabetic people with similar body mass indexes (BMIs), which might increase their risk of CVD. Some studies have associated VF in patients without diabetes to indicators of VF replacement.[1] In order to assess VF in T2DM participants who have limited access to specialized facilities, this study aimed to develop a quick and readily accessible alternative method.

METHODS

Of the 1,409 people with type 2 diabetes who were enrolled in this cross-sectional study, 538 had a normal body mass index. Two groups were developed based on visceral fat area (VFA): VF (+) (VFA ≥90 cm²) (n = 110) and VF (-) (VFA < 90 cm²) (n = 428). An Omron VF measuring device was used to collect the VFA data. Metabolic and anthropometric conditions were identified. LAP, or lipid accumulation product, is one of the new insulin resistance markers that was constructed. The chi-squared automatic interaction detector decision tree model, multifactorial binary logistic regression models, and univariate analysis were used to screen for factors linked to VF.

MICRO LABS LIMITED

Diabetes Update

Vol. 6 | Issue 52| 2025

RESULTS

About 52.8% (n=744) of the 1,409 T2DM individuals had a high VF rate, according to the decision tree model. In participants with T2DM (n = 1,409), the prevalence of VF (+) OB (-) (BMI ≤ 23.9 kg/m²) was 7.8%, while in those with normal BMI (n = 538), it was 20.4%. The neck circumference (NC) odds ratio (OR) in T2DM participants with normal BMI was 1.891 (95% CI: 1.165–3.069, P=0.010), according to the logistic regression model. From first to the fourth of the LAP quadrant, the OR for VF steadily rose (P <0.05). The decision tree model showed that LAP was the root node, followed by NC. According to the receiver operating characteristic curve (ROC) study, NC's area under the curve (AUC) for predicting high VF levels was 0.682 for females and 0.640 for males. For males and females, the ideal NC cut-off marks were 37.75 cm and 34.75 cm, respectively. Furthermore, the significant LAP cut-off points were 22.64 and 26.45 for males and females, respectively, with the AUC values of LAP in predicting high VF levels being 0.745 for males and 0.772 for females (Figure 1).

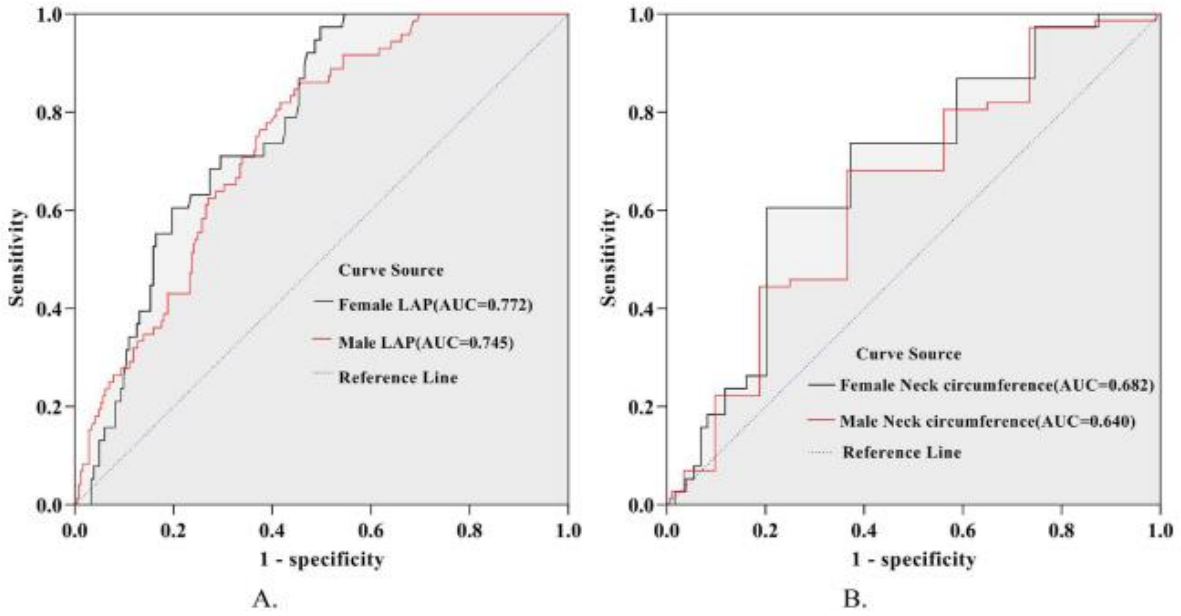


Figure 1. ROC analysis of LAP (A) and neck circumference (B) in T2DM patients with normal BMI

DISCUSSION

This study showed that in T2DM participants, NC may be a predictor of increased VF. Since NC was found to be the optimum cutoff value for predicting central obesity, there has been minimal research that particularly looks at the association between NC and high VF in T2DM participants.[3,4] In T2DM patients with normal BMI, LAP was found to be a positive indicator

of VFA in this study. A high LAP index was found to be independently associated with type 2 diabetes and could be used as a predictive sign in a prospective trial of 4,281 persons without diabetes who did not have systemic or abdominal obesity.[5]

CONCLUSION

NC is a simple and reliable measure to assess VF. The study showed that NC and LAP may predict increased VF in T2DM people with normal BMI.

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Association between continuous glucose monitoring-derived indicators and the risk of diabetic foot in type 2 diabetes mellitus

INTRODUCTION

Improved glucose control is crucial because CGM measurements, especially TIR and GRI, are strongly associated with the risk of DF in T2DM.

Diabetic foot (DF) is a common and serious consequence of diabetes. Numerous studies have demonstrated that poor blood glucose control contributes significantly to the initiation and progression of DF. Also, an increased risk of DF is associated with poor glycated hemoglobin (HbA1c) control, whereas intensive glycemic control therapy (HbA1c: 6%-7.5%) lowers the risk of amputation in DF patients by 35%. New continuous glucose monitoring (CGM) technology has been identified as the best way to get detailed glycemic information. In addition to HbA1c, CGM-derived glycemic profiles provide useful further information. These metrics include mean blood glucose (MBG), glycemic risk index (GRI), time in range (TIR), time above range (TAR), time below range (TBR), and coefficient of variation (CV).[1] In patients with DF, TIR has been reported to be negatively associated with

MICRO LABS LIMITED

Diabetes Update

Vol. 6 | Issue 52| 2025

the probability of amputation[2], and a decreased TIR has been associated with a greater likelihood of major amputation.[3] It is unknown, therefore, how precisely CGM indices—including TIR—affect the prevalence of DF. Thus, the purpose of this study was to determine the factors influencing the attainment of CGM indicators in people with DF and to examine the associations between CGM indices and the risk of DF in individuals with type 2 diabetes mellitus (T2DM).

METHODS

In this retrospective analysis, 591 people with type 2 diabetes (297 with and 294 without DF) were enrolled. The demographic information, including age, sex, duration of diabetes, family history of diabetes, present or past smoking and alcohol use, diabetic complications and comorbidities, hematological parameters, relevant clinical data, and 72-hour CGM data were collected. The following glucose metrics were calculated from the CGM data: maximum glucose fluctuation range (LAGE), TAR level 1, TAR level 2, TBR level 1, TBR level 2, CV, TIR, GRI, MBG, and CV. A logistic regression analysis was used to investigate the association between these measurements and DF risk.

RESULTS

DF patients had reduced TIR (all P <0.001) but higher mean blood glucose (MBG) and higher proportions of TAR, TAR level 1, and TAR level 2. Compared to patients without DF, patients with DF had significantly lower rates of reaching target ranges for TIR, TAR, and TAR level 2 (all P <0.05). According to logistic regression analysis, TIR had an inverse correlation with DF risk, but GRI, MBG, and TAR level 1 had a positive correlation (all P <0.05). The MBG, TIR, GRI, TAR level 1, and HbA1c area under the curve in ROC curve analysis were 0.619, 0.617, 0.609,

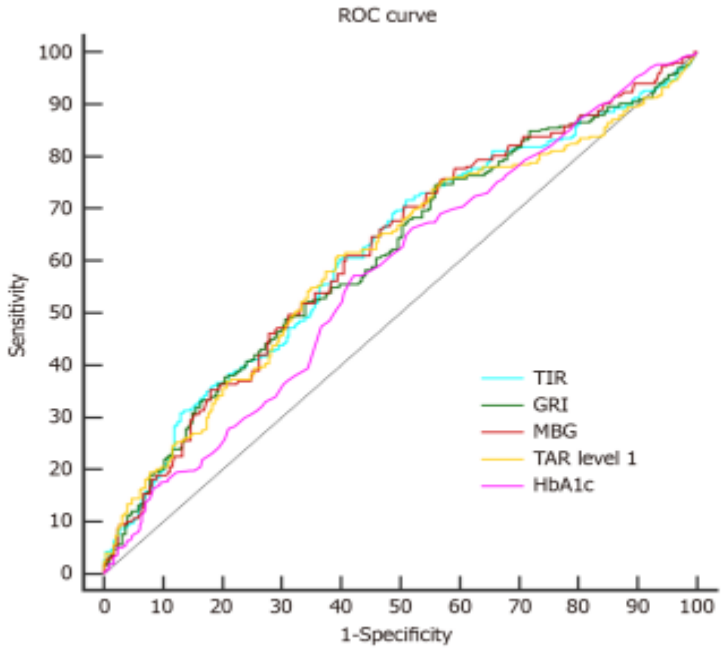

Figure 1. Analysis of receiver-operating characteristics to identify patients who are at risk for diabetic foot.

ROC: Operating characteristic of the receiver; GRI: Glycemia risk index; TIR: Time in range; TAR: Time above range; MBG: Mean blood glucose; Hemoglobin A1c: HbA1c.

0.607, and 0.574 respectively. MBG, TIR, TAR level 1, TAR level 2, and HbA1c cutoff thresholds were 8.69, 77.78, 19.23, 20.63, and 9.03, respectively (all P <0.05) for DF prediction (Figure 1). HbA1c levels and white blood cell count had an inverse relationship with achieving TIR and TAR (P <0.05). Additionally, body mass index, duration of diabetes, fasting plasma glucose, and usage of antidiabetic medications all had an impact on reaching TAR.

DISCUSSION

The relationship between CGM indices and DF risk has not been extensively studied in recent years. In the present study, the incidence of DF reduced as TIR quartiles increased (P for trend <0.05). Even when HbA1c and other variables were considered, multinomial logistic regression showed that a 10% increase in TIR was associated with a 13.3% decreased DF risk. According to the current study, increases in MBG, TAR level 1, and TAR level 2 have been associated with different levels of DF risk. The American Diabetes Association (ADA) suggests that for the majority of T2DM patients, the target TIR should be greater than 70%.[4] Lower extremity arterial disease and peripheral neuropathy have been associated with an increased risk of DF when TIR is decreased.[5,6]

CONCLUSION

This study showed that GRI, MBG, and TAR level 1 were positively associated with DF risk, whereas TIR had a negative correlation with DF risk. Even after considering HbA1c and other risk variables, these relationships were still significant. The results of the study imply that these CGM-derived indices, which provide logical assessments of glycemic control, could be helpful in determining whether DF occurs in T2DM patients.

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MICRO LABS LIMITED

Diabetes Update

Vol. 6 | Issue 52| 2025

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Impact of a Circuit Training Program on changes in Myokines Levels in Insulin-Resistant Women

INTRODUCTION

In women newly diagnosed with insulin resistance, the circuit training program markedly raised serum IL-6 levels but not IL-10, FGF21, or irisin levels.

It has long been known that exercise training (T) is an essential non-pharmacological treatment for diabetes and insulin resistance (IR). Muscles are stimulated by physical exercise, which increases hormone activity and causes the production of peptides, microRNAs, and exosome cytokines—collectively referred to as myokines. Myokines have a significant effect on inflammation and energy metabolism. They also raise insulin sensitivity, which enhances glucose utilization and controls lipid and glucose metabolism.[1] Studies suggest that when treating metabolic diseases, a combination of aerobic and resistance training may be more effective than either training type alone.[2] The purpose of this study was to determine whether a moderately intense circuit T program could change the myokine profile, given the evidence that myokines, which are produced by a combination of aerobic and resistance T, can prevent IR progression.[3] This study also identified whether these alterations may further raise the muscle tissue's sensitivity in women who have just received an IR diagnosis.

METHODS

In this prospective controlled study, 42 women were randomly assigned to one of two groups: the training (T) group (n = 28) or the non-training (NT) group (n = 14). The training group engaged in three months of circuit training, which consisted of three 33-minute sessions each week, including strength exercises (80% to 80% of one-repetition maximum) and endurance workouts (50-75% of heart rate reserve). Two cardio machines and five weights were used for the exercises. Their prior activity was unchanged for the control non-training group. Interleukin (IL)-6, IL-10, fibroblast growth factor 21 (FGF21), and irisin levels were assessed both before and after the intervention, along with body composition indices. The analysis of variance (ANOVA) using two-way repeated measures was used to examine the data for 27 patients.

MICRO LABS LIMITED

Diabetes Update

Vol. 6 | Issue 52| 2025

RESULTS

After 12 weeks, the T group's fat-free mass grew significantly, while the NT groups remained unchanged. Over the course of the 12-week trial, a significant group × time interaction for IL-6 levels was noted ($p < 0.05$). Also, Significant interindividual heterogeneity was shown by the T group's non-uniform IL-6 values. Over the same time, there was no significant difference in the levels of irisin, FGF21, or IL-10 between the T and TN groups. For irisin, FGF21, and IL-10, repeated measures ANOVA did not show any significant group × time interactions. Over the course of 12-week trial period, the T group's serum IL-6 levels significantly increased when compared to the NT group (Figure 1). Irisin concentrations before and after giving T had a positive association with arm fat composition.

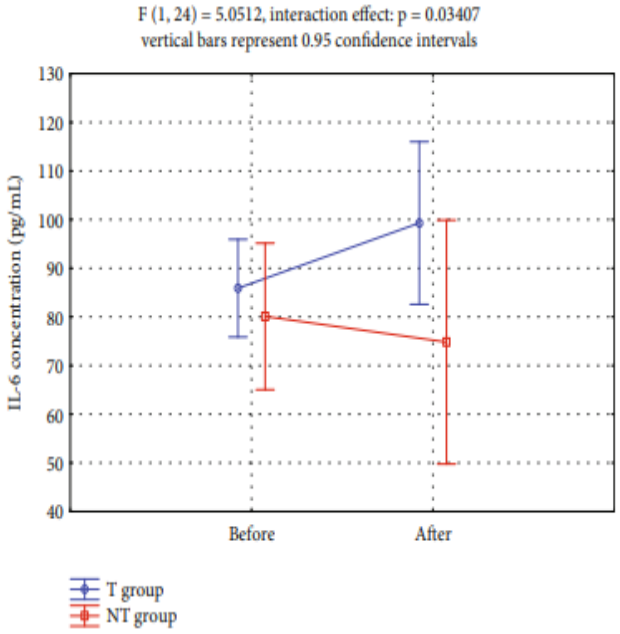

Figure 1. The T and NT groups' serum IL-6 levels before and after the T intervention.

DISCUSSION

Both the T (85.9 ± 23 pg/mL) and NT (80.1 ± 12 pg/mL) groups in this study had elevated IL-6 levels prior to the circuit T program. In addition to being a contributing component in the development of inflammation, IR, and β-cell dysfunction, a high level of circulating IL-6 is an independent predictor of type 2 diabetes.[4] Increased insulin secretion in insulin-resistant states may be counteracted by elevated blood IL-6 levels in these conditions. Febbraio and Pedersen proposed that to downregulate other metabolic dysfunctions, IL-6 may be increased in illness conditions because of the disruption rather than as a cause.[5] According to Garneau and Aguer, IL-6 resistance is present in the muscles of T2DM patients.[6]

CONCLUSION

The circuit T program did not change the levels of irisin, FGF21, or IL-10, but it significantly increases the levels of IL-6 in the serum of women recently diagnosed with IR.

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Case Report on Diabetic ischemic ulcers with toe deformities

INTRODUCTION

Revascularization followed by surgical offloading provided excellent outcomes in a diabetic ischemic ulcer with toe deformity.

Offloading therapy plays a crucial role in treating diabetic ischemic ulcers, particularly when toe deformities are present. Although the total contact cast is considered the gold standard for offloading diabetic foot ulcers, it is unsuitable for ischemic limbs due to the risk of tissue damage and ulcer worsening caused by compression. For ischemic limbs, removable knee-high offloading devices are preferred as they provide effective pressure relief while allowing wound monitoring and infection management. When ulcers persist or recur despite appropriate offloading, surgical interventions may be required. These can include procedures such as Achilles tendon lengthening, metatarsal head resection, and arthroplasty.[1] Managing diabetic foot ulcers (DFUs) complicated by ischemia and deformities is clinically challenging, often necessitating both revascularization and offloading for successful treatment. Nonetheless, the 2023 IWGDF guidelines do not provide detailed criteria for assessing blood flow or clear recommendations for surgical offloading.[2] This case report showed the effective management of a complicated diabetic ischemic ulcer through a multidisciplinary strategy involving revascularization and surgical offloading.

CASE PRESENTATION

MICRO LABS LIMITED

Diabetes Update

Vol. 6 | Issue 52| 2025

A 70-year-old man with a 20-year history of type 2 diabetes mellitus presented with an HbA1c level of 6.8%, indicating moderate glycemic control. His diabetes was managed through a combination of oral antidiabetic medications, including metformin and sulfonylurea, along with a basal–bolus insulin regimen. He also had a history of dyslipidemia treated with statins, diabetic neuropathy, and peripheral arterial disease, leading to ischemic ulcers on the right first and second toes. Treatment included percutaneous transluminal angioplasty (PTA) and amputation of the right first and second rays. Post-surgery, the patient was provided with an ankle–foot orthosis and routine callus care. Due to poor adherence to orthotics, worsening ischemia, and progressive toe deformities, new ulcers formed on the dorsal surface of the right third toe and the plantar aspect of the third metatarsal head. These ulcers measured 18 × 15 mm and 20 × 15 mm, respectively, with extension to the fascia and surrounding erythema. According to the WIfI classification, they were categorized as W1I2fI2 (Stage 4) and W2I2fI2 (Stage 4). Plantar pressure mapping indicated elevated pressure at the third toe's metatarsophalangeal (MTP) joint, measuring 6.61 kPa/cm² (Figure 1a). Revascularization was prioritized, and within 48 hours post-procedure, normalized SPP values confirmed its success. Antibiotic therapy was continued to treat infection, followed by surgical offloading after infection resolution. Angiography revealed significant stenosis, including 75% in the anterior tibial artery, 90% in the dorsal foot artery, and distal branch occlusion of the posterior tibial artery. PTA with balloons restored in-line flow to the third toe's plantar arteries. Surgical procedures included PIP joint resection arthroplasty and metatarsal shortening osteotomy to alleviate pressure at the ulcer

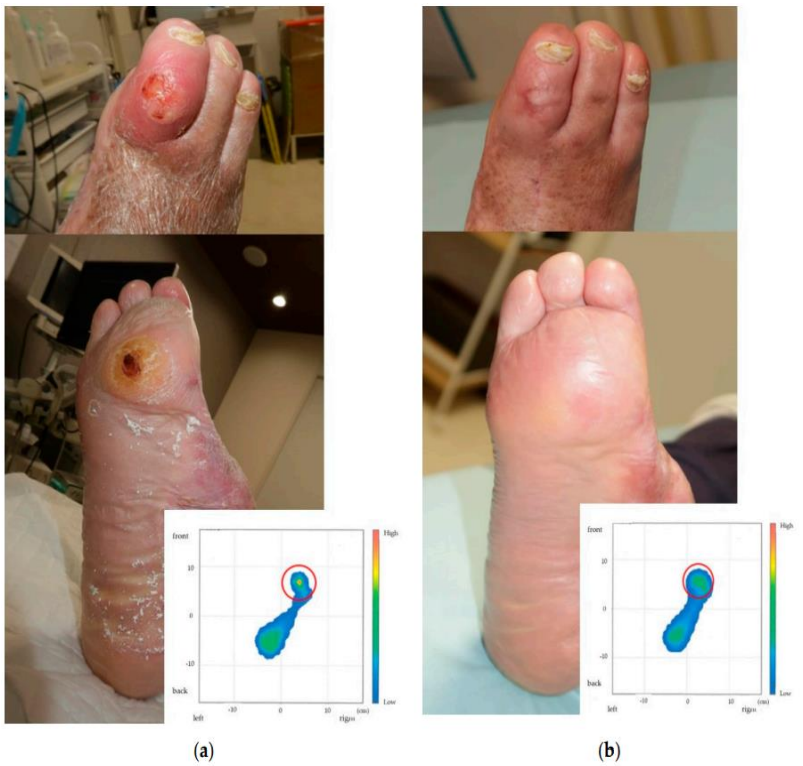

Figure 1. Foot images taken before and after surgery, as well as measurements of plantar pressure. (a) Significantly higher plantar pressure (6.61 kPa/cm^2) is highlighted by preoperative ulcers on the third toe's dorsal PIP joint and plantar MTP joint (red circle). (b) Pressure reduction to 3.54 kPa/cm² and postoperative healing (red circle).

sites. A standardized dressing protocol was followed postoperatively, with an uneventful recovery and no wound infections. Plantar pressure at the MTP joint decreased to 3.54 kPa/cm² (Figure 1b). Therapeutic sandals were used during recovery, and custom orthopedic shoes with pressure-redistributing insoles were provided upon complete healing. At the three-year follow-up, the patient remained ulcer-free without recurrence of deformities or new ulcerations.

DISCUSSION

Claw toe deformities are frequently observed in diabetic patients and are more complex than those in non-diabetic individuals due to disease-specific biomechanical and histological changes, including neuropathy, chronic hyperglycemia, and intrinsic muscle atrophy. These deformities increase plantar pressure, heightening the risk of ulcer formation. Surgical offloading became necessary to alleviate mechanical stress at ulcer sites where plantar pressure exceeded 6.61 kPa/cm². Following the procedure, plantar pressure was reduced to 3.54 kPa/cm², meeting offloading objectives and playing a key role in ulcer prevention and improved long-term outcomes.[3] Revascularization is crucial for enhancing wound healing capacity, primarily by restoring in-line blood flow and achieving SPP values of 50 mmHg or higher, which are associated with favorable outcomes.[4]

CONCLUSION

The combination of revascularization and surgical offloading proved to be an effective treatment for a diabetic ischemic ulcer complicated by toe deformity. This case highlights the importance of personalized approaches in managing complex diabetic foot conditions and preventing recurrence.

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MICRO LABS LIMITED

Diabetes Update

Vol. 6 | Issue 52| 2025