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## Diabetic Foot Ulcer

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Mohammad Zubair • Jamal Ahmad  
Abida Malik • Mallikarjuna Rao Talluri  
Editors

# Diabetic Foot Ulcer

An Update

### *Editors*

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## Preface

Diabetes mellitus (DM) is a chronic disorder (an excess of glucose levels in blood) because insulin is no longer produced in the pancreas (type I DM) or the body is unable to utilize produced insulin in the body properly (type II DM). DM is the world's most endemic and mortality causing disease affecting more than 6% of the adult population. The growth rate of DM patients has been increasing rapidly due to different factors such as genetic, environmental, lifestyle, increased calorie intake, and less body exercise. But the development of medication is not as much as the growth rate of DM and its complications. Type I DM has no preventive medicine, but type II can be prevented and controlled by maintaining a healthy lifestyle. However, their complications can be delayed by taking insulin therapy.

The complications of DM have more impact on different metabolisms in the body and are not specific to any particular disease, because insulin is the principal hormone responsible for the uptake of glucose from blood to different cells of the body. DM mainly damages the blood vessels and leads to the preliminary complications in the eyes, kidneys, and nerves. All these complications are interlinked to each other because glucose is the principal fuel for cellular functions. The damage of nerves due to DM is known as diabetic neuropathy (DN); its main symptoms are numbness and tingling that lead to skin damage.

Skin damage due to DM is because of peripheral arterial damage, i.e., lower blood circulation. Diabetic foot ulceration/diabetic foot ulcer (DFU) is one of the foremost DM complications associated with it and sometimes may cause amputation.

The availability of information on DFU prevalence, major symptoms, pathogenesis, complications, treatments, and management was very less. This book provides updated knowledge on the prevalence of DFU around different parts of the world, its development, pathophysiology, major complications, and new methodologies in its treatment. The editors sincerely acknowledge the efforts of authors in manifesting their perspectives about DFU.

*Shamina Begum* et al. describe the occurrence of DM, its complications, and the current scenario about prevalence, risk factors, and different strategies and policies to control DFU around Asia and European continents.

*Zulfiqarali G. Abbas* explains the common causes of DFU, in relation to peripheral neuropathy, and analyzes over the last two decades conditions of DFU complications and prevention and control programs in Africa and Antarctica.

*Kanakamani Jeyaraman* presents the implications of DFU in relation to clinical, social, and economic problems because of endemic type II DM and the annual outlay on DM and its complications including DFU in American and Australian continents.

*Ayman Faisal Foad* explains the pathophysiology of wound healing with respect to different control factors and importance of proteins and vitamin C in wound healing.

*Hyder O. Mirghani* describes the different approaches for image (scanning) models to differentiate harm at various tissue levels for providing the remedial approaches to different foot inflammation including DFU due to DM.

*Mohammad Zubair and Farha Fatima* demonstrates the various complications due to DM, mainly focused on development of DFU, and explains the risk factors for DFU development and approaches for timely diagnosis to overcome complications of DFU.

*Ahmad Faraz et al.* explain the major healthcare challenges in the twenty-first century and how DM and its complications impact the mortality rate around the globe and also elucidate the association of diabetic neuropathy with the diabetic foot abnormalities.

*Tarek Kabil* describes the association of inflammation wounds with different microbes (aerobic and anaerobic) and their involvement in DFU and its complications.

*Fohad Mabood Husain et al.* illustrate the DFU and DN contribution for the development of different pathogenic microorganisms at infectious sites and how these microbial infections lead to tissue and bone injury.

*M. Oves et al.* illustrate the hidden role of fungus in infection management.

*Thomas Thanyath* demonstrates the risk factors for DFU, and evaluation of DFU at appropriate stages in different diabetic patients using various identification methods.

*Hamid Ashraf et al.* explain the management of different microbial infections associated with DFU using different antibiotics.

*Vijay Viswanathan and Sai Prathiba A.* explain the recent circumstances about the DFU and its treatments in the Indian subcontinent.

*Zulfiqarali G. Abbas* elucidates complications, its prevalence, and management strategies to control and prevent DFU in developing countries.

*Deepti Singh and Hifzur R. Siddique* discuss about the role of different growth factors, their usage in control and prevention, and future prospects in DFU management.

*Rashid Mir et al.* expound the current approaches in the control, prevention, and treatment of DFU and also explain the role of stem cell therapy in different wound healing infections including DFU management.

*M. Ahmed Mesaik et al.* explain the importance of alternative medicine (AM) against the rising of global DM patients and the management of AM in the DM and its complications including DFU and diabetic foot infections (DFIs).

*Mohamed Ali-Seyed and Ayesha Siddiqua* enlighten the role of phytomedicine (traditional medicine) and herbal formulations in the treatment of DM and

DFU. They also explain the possible mechanism of action of important medicinal plants against DM and their future scope in identification of different phytochemicals against DM, DFU, and other complications.

*Sumbul Rehman* explains the common complications including DFU due to prolonged high blood glucose levels and the management of bloodletting by leeching therapy using *Hirudo medicinalis*.

*Mohammad Azam Ansari* et al. describe the prevalence of DM and DFU complications and emphasize the delayed wound healing because of DFU, possibly employing nanotechnology in the management of DM and DFU treatment using nanoformulations.

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# Contents

## Part I World Preview

- 1 Diabetic Foot Complications in Asia and European Continents . . . . . 3**  
Shamina Begum, Mohammad Zubair, Marai M. Alamri,  
Fohad Mabood Husain, Farha Fatima, Mohammad Oves,  
Mohammad Azam Ansari, and Iftekhar Hassan
- 2 Diabetic-Foot Complications in African  
and Antarctica Continents . . . . . 29**  
Zulfiqarali G. Abbas
- 3 Diabetic-Foot Complications in American  
and Australian Continents . . . . . 41**  
Kanakamani Jeyaraman

## Part II Complications and Treatments Updates

- 4 Acute and Chronic Wound Healing Physiology . . . . . 63**  
Ayman Faisal Ahmed Foad
- 5 Screening of Foot Inflammation in Diabetic Patients by  
Noninvasive Imaging Modalities . . . . . 77**  
Hyder O. Mirghani
- 6 Molecular Mechanism and Biomechanics of the  
Diabetic Foot: The Road to Foot Ulceration and Healing. . . . . 87**  
Mohammad Zubair and Farha Fatima
- 7 Foot Pressure Abnormalities, Radiographic,  
and Charcot Changes in the Diabetic Foot. . . . . 121**  
Ahmad Faraz, Hamid Ashraf, Saifullah Khalid, and Razeen Fatima
- 8 Aerobic and Anaerobic Bacterial Infections  
and Treatment Strategies . . . . . 135**  
Tarek Hassan M. Kabil

<b>9</b>	<b>MRSA, EBSL, and Biofilm Formation in Diabetic Foot Ulcer Infections.</b>	<b>149</b>
	Fohad Mabood Husain, Mohammad Shavez Khan, Mohammad Zubair, Altaf Khan, Saba Noor, Iftekhhar Hassan, Mohammed Arshad, Mohd Shahnawaz Khan, Faizan Abul Qais, and Salman Al-Amery	
<b>10</b>	<b>Fungal Infection: The Hidden Enemy?</b>	<b>161</b>
	Mohammad Oves, Mohd Ahmar Rauf, Fohad Mabood Husain, Mohammad Zubair, Iqbal M. I. Ismail, and Arun Iyer	
<b>11</b>	<b>Diabetic Foot Syndrome: Risk Factors, Clinical Assessment, and Advances in Diagnosis.</b>	<b>177</b>
	Thomas Antony Thaniyath	
<b>Part III Developments, Future Prospective, New Possible Treatments</b>		
<b>12</b>	<b>Advances in Prevention and Empirical Treatment of Diabetic Foot Infection.</b>	<b>201</b>
	Hamid Ashraf, Jamal Ahmad, and Anees Akhtar	
<b>13</b>	<b>Prevention of Diabetic Foot: Indian Experience</b>	<b>215</b>
	Vijay Viswanathan and A. Sai Prathiba	
<b>14</b>	<b>Low-Cost Management of Diabetic Foot</b>	<b>221</b>
	Zulfiqarali G. Abbas	
<b>15</b>	<b>Role of Growth Factors in the Treatment of Diabetic Foot Ulceration</b>	<b>233</b>
	Deepti Singh and Hifzur R. Siddique	
<b>16</b>	<b>Stem Cells in the Treatment of Diabetic Foot Ulcers.</b>	<b>251</b>
	Rashid Mir, Imadeldin Elfaki, Ajaz Ahmad Waza, and Faisel M. AbuDuhier	
<b>17</b>	<b>Alternative Medicine in the Management of Diabetic Foot Ulcers/Infections.</b>	<b>269</b>
	M. Ahmed Mesaik, Hyder O. Mirghani, and Fakhralddin Elfakki	
<b>18</b>	<b>Modern Phytochemistry in Treating Diabetic Foot Ulcer: Progress and Opportunities</b>	<b>281</b>
	Mohamed Ali Seyed and Siddiqua Ayesha	
<b>19</b>	<b>Management of Diabetic Foot Ulcer by <i>Hirudo medicinalis</i>, the “Healing Leech”</b>	<b>315</b>
	Sumbul Rehman	
<b>20</b>	<b>Nanotechnology and Diabetic Foot Ulcer: Future Prospects</b>	<b>331</b>
	Mohammad Azam Ansari, Khursheed Ali, Zeba Farooqui, Hanan A. Al-Dossary, Mohammad Zubair, and Javed Musarrat	
	<b>Correction to: Nanotechnology and Diabetic Foot Ulcer: Future Prospects</b>	<b>C1</b>



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**Mohammad Zubair** is an Assistant Professor at the Department of Medical Microbiology, Faculty of Medicine, University of Tabuk, Kingdom of Saudi Arabia. He completed his PhD and post-doctorate research on diabetic foot infections and has extensive teaching and research experience in the field of medical science. His research focuses on the extended spectrum beta-lactamase gene (CTX, TEM & SHV), pro and anti-inflammatory cytokines, healing proteins and their clinical correlations. He has published more than 35 papers in international, peer-reviewed journals, and has presented his work at various international conferences. He is also the recipient of the prestigious “Marvil Levin” research awards presented by the American Diabetes Association (ADA) at the 72nd Scientific Session held at Philadelphia, USA.

**Jamal Ahmad** is a former Professor of Endocrinology; ex Dean of the Faculty of Medicine, J.N. Medical College; and ex Director of the Rajiv Gandhi Centre for Diabetes & Endocrinology, Faculty of Medicine, Aligarh Muslim University, India. He has made a significant contribution toward determining the role of protein glycation in diabetes and its associated complications. He has published more than 240 research articles in various international and national journals, was Principal Investigator or Co-Investigator in a number of research projects, and has completed 9 phase III international, multi-centre, multicounty new drug trials in diabetes mellitus. He is a former President of the Endocrine Society of India, and the recipient of the prestigious RSSDI fellowship-2015 and a Lifetime Achievement Award by Diabetes India 2019.

**Abida Malik** is a former Professor and Chairperson of the Department of Microbiology, and the former Dean of the Faculty of Medicine, Jawaharlal Nehru Medical College, Aligarh Muslim University. A leading Indian microbiologist, she has over 41 years of teaching and research experience and authored more than 185 publications. She established the Virology Lab in 1976, Mycology lab in 1980 and was founded and responsible for the AIDS Surveillance Centre for 20 years. She is the former president of the Indian Association of Microbiologists, and received the Dr U. C. Chaturvedi Life Time achievement Award for her services to microbiology in 2011.

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