



The Diabetic Foot

SECOND EDITION

EDITED BY

Aristidis Veves, MD, DSc

John M. Giurini, DPM

Frank W. LoGerfo, MD

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THE DIABETIC FOOT

CONTEMPORARY DIABETES

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SERIES EDITOR

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PREFACE

It has been more than 4 years since the first edition of *The Diabetic Foot* was published. Over this period of time, it has become absolutely clear that diabetes is becoming a pandemic that challenges the health care resources of all societies, from the developing ones to the most advanced. It is therefore not surprising that diabetic foot disease is still a major problem and, if anything, is growing in size rather than coming under control.

One positive development is that our knowledge of the pathophysiology of foot problems in diabetes has considerably expanded. Furthermore, it has been realized that impairment in wound healing is associated with pathways that are related to the development of cardiovascular disease, both in the micro- and macrocirculation.

In *The Diabetic Foot: Second Edition*, we have tried to keep the spirit of the first edition, which is to give the interested reader a full view of diabetic foot disease and to emphasize the need for a multidisciplinary approach in its management. As with the first edition, we have relied on the long tradition of the Joslin-Beth Israel Deconess Foot Center, one of the oldest and most experienced diabetic foot centers. We have also tried to emphasize new developments in basic and clinical research that we hope will be translated to clinical practice in the future. It is our hope that *The Diabetic Foot: Second Edition* will be helpful not only to clinicians but also to the research community with an interest in this field.

Aristidis Veves, MD, DSc
John M. Giurini, DPM
Frank W. LoGerfo, MD

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Introduction to Diabetes

Principles of Care in the Surgical Patient With Diabetes

Peter Sheehan, MD

INTRODUCTION

The medical and surgical management of foot disorders in the patient with diabetes should have as its basis a thorough understanding of the complications and metabolic consequences of diabetes mellitus. This is especially true in the patient who is undergoing a surgical procedure. Diabetes is rapidly increasing in prevalence worldwide and surgery in patients with diabetes is more common. Foot complications are already a major cause of admissions for diabetes, and comprise a disproportionately high number of hospital days because of increased surgical procedures and prolonged length of stay.

With advances in surgical techniques and anesthesia, surgery has become safer for patients with diabetes; nonetheless, patients with diabetes are high-risk group for perioperative complications, such as infection and myocardial infarction (MI). These may be avoided or minimized with proper anticipation and awareness of the patient's medical condition. Despite the increase in morbidity and mortality that has been observed in the surgical patient with diabetes, there are no widely accepted guidelines for the many clinical issues that are present in the perioperative period. The objective of this chapter is to present current concepts in the assessment and management of the surgical patient with diabetes, as well as the pathophysiological basis on which these concepts rest. To this end, an overview of diabetes mellitus and its complications also will be presented, with the understanding that more thorough reviews exist elsewhere, which are beyond the scope of this chapter.

OVERVIEW OF DIABETES AND ITS COMPLICATIONS

Epidemiology

In the past few decades, there has been an alarming rise in the prevalence of diabetes, particularly type 2 diabetes. In the well-studied town of Framingham, Massachusetts, the prevalence has risen from 0.9% in 1958 to 3% in 1995 (1). Recently, the Centers for Disease Control estimated the US prevalence of diagnosed diabetes at 7.3% in 2001, in comparison with a similar study in 1990 reporting 4.9%, representing nearly a 48% increase over the decade (2). Most disturbing was a 76% increase in the prevalence among

the 30–39 year age group. Furthermore, there exists a nearly as large group in the population who are undiagnosed. This estimate comes from the National Health and Nutrition Examination Survey (NHANES) II and III studies of large-scale population screening, in which only 50% of people found to have diabetes were previously diagnosed (3).

The increased prevalence of diabetes in the United States is correlated with the rising rates of obesity, which now afflicts more than 20% of adult Americans. The prevalence of diagnosed diabetes also increases with age, affecting more than 10% of those over 65 years of age in the United States. It is also slightly over-represented in women in comparison with men. Some ethnic populations have a two- to fivefold increase in risk of developing diabetes. The highest incidence is seen in Native Americans, followed by Hispanics, African Americans, Asians, and Pacific Islanders. The risk of diabetes in all groups is associated with higher rates of obesity and, more specifically, with an increase in the waist–hip ratio, a measure of central adiposity.

Worldwide, the rates of diagnosed diabetes are rising, especially in developing nations. Indigenous peoples of the Americas and Polynesia are those with the highest risk. The Pima tribe in Arizona has the highest prevalence of type 2 diabetes in the world, affecting nearly 50% of all adult members. Asians and Africans are of intermediate risk. People of European descent are actually among those with the lowest risk of developing diabetes (4). Most epidemiological studies suggest that lifestyle changes introduced with increasing industrialization and economic development may be responsible. Higher prevalence of diabetes can also be seen in urban dwellers *vis-a-vis* their rural counterparts. The obvious contributing factors are a more abundant and richer diet, a sedentary lifestyle, and higher rates of obesity.

One cohesive theory tying the genetic predisposition of type 2 diabetes seen in certain ethnic groups to a higher prevalence of obesity is one of the “thrifty phenotype” (5). According to this hypothesis first proposed by Neel in 1962, these high-risk ethnic groups, primarily indigenous peoples, have been adapted over the millennia to survive conditions of scarcity and episodic “feast or famine.” As a consequence of natural selection, they have developed a degree of metabolic efficiency, or “thriftiness,” that allows storage of ingested calories as fat with less energy expenditure or waste. This predisposes therefore to higher tendency to obesity, especially of the central type, when placed in an environment of surfeit, rich foodstuffs. With the development of obesity, there is in turn insulin resistance and a greater risk of type 2 diabetes.

At this time, approx 1% of the population of China has diabetes, but the prevalence is rising, especially in urban areas. Indeed, the prevalence of diabetes is approx 4% in Beijing. It is estimated that if that country assumes a more industrial, Western lifestyle, the prevalence would rise to 8–10%. This alone would cause nearly a doubling of the world’s population with diabetes. Similar projections are proposed for South Asians as well. It is clear that we are presently in a pandemic of diabetes that will pose an even greater and more frequently encountered medical issue. The decade of incident diabetes has now given way to a time of prevalent diabetes. This portends a new wave of chronic diabetic complications presenting in the coming decade.

Diagnosis

An expert committee of the American Diabetes Association (ADA) amended the diagnostic criteria for diabetes mellitus in 1997 (6). Previously, the diagnosis was made