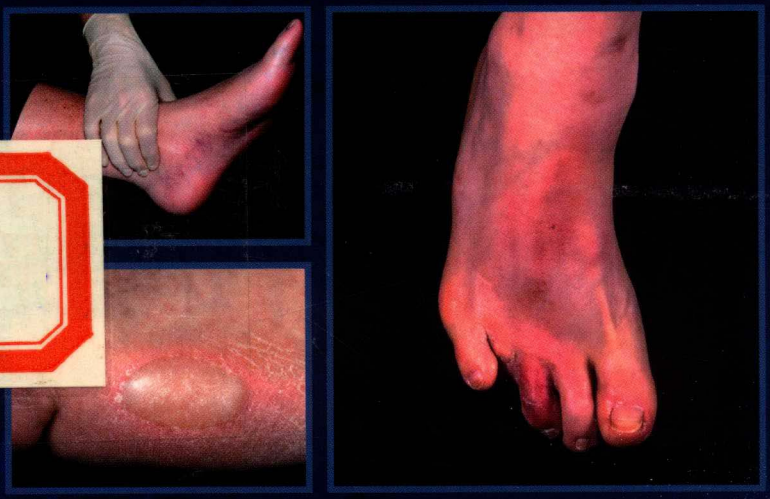
THIRD EDITION

Managing the Diabetic Foot

Michael E. Edmonds
and Alethea V.M. Foster



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Managing the Diabetic Foot

DEDICATION

This book is dedicated to all health-care professionals that faithfully and valiantly look after diabetic patients with foot problems throughout the world.

The authors' royalties from this book will be devoted to the Ali Foster Travel Fund, which will support young practitioners to visit centres of excellence to enrich their experience and expertise.

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This is a practical hands-on manual uninterrupted by references. At the end of the book we have given a further reading list.

Preface

It was C.S. Lewis who said 'I wrote the books I should have liked to read if I could have got them.' and this was rather our approach when we first developed *Managing the Diabetic Foot*. Back in 2000, our aim was to fill what we perceived as a need for a very practical handbook. We wanted a book that could be used within the clinic as a basis for rapid and effective clinical decisions; a book incorporating a very simple and practical method of classifying and staging the diabetic foot that could be used as a framework for care, even by health-care practitioners who did not necessarily have a lot of previous experience in managing the diabetic foot. We wanted a book that would be useful for all members of the diabetic foot multidisciplinary team, a book that would help individual members of the team to appreciate the differing roles of other members, and above all, a book to emphasize the need for a multidisciplinary team approach in this most challenging field of health care; a book that could save the lives and limbs of diabetic foot patients.

These principles live on in this third updated edition of *Managing the Diabetic Foot*. Since the second edition in 2005, we have refined our classification of the diabetic foot, subdividing the ischaemic foot into the neuroischaemic foot, the critically ischaemic foot, acutely ischaemic foot and the renal ischaemic foot. We have developed our simple staging system, to emphasize that there is a rapid progress to necrosis in the natural history of the diabetic foot and this amounts to what we call a 'diabetic foot attack', which demands immediate treatment just like a heart or brain attack.

Over the years we have been increasingly alarmed by the devastating impact of neuropathy on our patients and have developed the concept of the need to practise neuropathic medicine. When classical signs of disease are absent or minimal and yet the pathology advances quickly, practitioners need to be aware of this and act like good detectives to

recognize the early and subtle signs of disease and react quickly. When it is not possible to rely on the nervous system to reflect accurately what is going on inside the body, we have to use modern imaging more readily. This edition has illustrated the use of single-photon emission computer tomography and conventional computed tomography (SPECT/CT) in the diagnosis of Charcot foot, grey-scale ultrasound and magnetic resonance imaging (MRI) in the diagnosis of infection and CT angiography and magnetic resonance angiography in delineating disease of the peripheral arterial system.

We describe major advances in the management of the diabetic foot since 2005. Reconstruction of the unstable Charcot hindfoot by internal stabilization has saved legs from certain amputation. Revascularization of the ischaemic foot has recently been achieved by very distal angioplasty and bypasses to the plantar arteries of the foot as well as by hybrid techniques involving both angioplasty and bypass in the same leg. Wound healing has also progressed with the increasing usage of negative pressure wound therapy and soft tissue reconstruction techniques including skin grafts and flaps. There has been increasing use of intravenous antibiotic therapy in the patients' homes utilizing peripherally inserted central catheter lines.

We stress the importance of the foot protection team in the community as well as the multidisciplinary foot care team based in the diabetic foot clinic, to which patients should have ready and open access when they are in trouble. We have come to learn that such is the vulnerability of the diabetic foot patient that the clinic door must always be open to give rapid treatment to a patient having a 'diabetic foot attack'.

My co-author Ali Foster sadly died at the initial stages of this third edition. However, Ali had been greatly involved in the planning of this edition and I hope her thoughts and experience of her beloved diabetic foot patients live on in this completed edition.

In tribute to Ali Foster at the International Symposium on the Diabetic Foot in 2011, I stated that she was a great source of inspiration to us

all. Ali transformed diabetic podiatry and planted seeds of friendship throughout the world. Indeed, these have lived on and will never die. Ali was a great teacher and keen to share her experience and expertise with all health-care professionals. To honour this, the authors' royalties from this book will be devoted to the Ali Foster Travel fund to support the visit of young foot practitioners to centres of excellence of their choice.

I sincerely hope (as also did Ali) that this third edition will be of assistance to all heath-care professionals throughout the world who so nobly strive to look after diabetic patients with foot problems. May it help to improve their outcome and prevent amputations, an aspiration to which Ali was so unselfishly devoted.

Michael E Edmonds
Alethea VM Foster (died January 2011)
London 2013

Abbreviations

ABPI	ankle brachial pressure index
ACCORD	Action to Control Cardiovascular Risk in Diabetes
AFO	ankle–foot orthosis
b.d.	twice daily
BCM	bilayered cellular matrix
CAPD	continuous ambulatory peritoneal dialysis
CARDS	Collaborative-AtoRvastatin Diabetes Study
CAV/VVHD	continuous arteriovenous/venovenous haemodialysis
cm	centimetre
CROW	Charcot restraint orthotic walker
CRP	C-reactive protein
CT	computed tomography
CTA	computed tomography angiography
DCCT	Diabetes Control and Complications Trial
DSA	digital subtraction angiography
ECG	electrocardiogram
ECM	extracellular matrix
EDIC	Epidemiology of Diabetes Interventions and Complications
eGFR	estimated Glomerular Filtration Rate
ESBLs	extended-spectrum beta lactamases
EVA	ethylene-vinyl acetate
g	grams
GFR	Glomerular Filtration Rate
h	hour
HD	intermittent haemodialysis
HDF	haemodiafiltration
HDL	high-density lipoprotein
Hg	mercury

HOPE	Heart Outcomes Prevention Evaluation
HPS	Heart Protection Study
Hz	hertz
IM	intramuscular
IV	intravenous
L	litre
LDL	low-density lipoprotein
min	minutes
mL	millilitre
mm	millimetre
mol	mole
mmol	millimole
MRA	magnetic resonance angiography
MRI	magnetic resonance imaging
MRSA	methicillin-resistant *Staphylococcus aureus*
NPWT	negative pressure wound therapy
o.d.	once daily
po	orally
PTA	percutaneous transluminal angioplasty
PNA	partial nail avulsion
PRAFO	pressure relief ankle foot orthosis
q.d.s.	four times daily
s	seconds
SPECT	single-photon emission computed tomography
t.d.s.	three times daily
TENS	transcutaneous electrical nerve stimulation
UKPDS	United Kingdom Prospective Diabetes Study
V	volts

Contents

1

Introduction

NEW APPROACH TO THE DIABETIC FOOT

Diabetes has reached epidemic proportions, and with it has come a growing number of complex diabetic foot problems. This book is written to help practitioners tackle these problems. It attempts to give enough simple practical information to enable practitioners to understand the natural history of the diabetic foot, rapidly diagnose its problems and confidently undertake appropriate interventions in a timely manner.

Three great pathologies come together in the diabetic foot: neuropathy, ischaemia and infection. Their combined impact results in a swift progression to tissue necrosis, which is the fundamental hallmark of the natural history of the diabetic foot. Progress towards necrosis can be so rapid and devastating that it has come to be regarded as a 'diabetic foot attack', similar to the heart and brain attacks of the coronary and cerebrovascular systems. A 'diabetic foot attack' can quickly reach the point of no return, with overwhelming necrosis. Thus, it is vital to diagnose it early and provide rapid and intensive treatment. Furthermore, it is important to achieve early recognition of the at-risk foot so as to institute prompt measures to prevent the onset of the 'diabetic foot attack'. Although there have been many advances in the management of the diabetic foot, it nevertheless remains a major global public health problem. All over the world, health-care systems have failed the diabetic foot patient and a major amputation occurs every 20 s. However, amputations are not inevitable.

In this book we describe a system of multidisciplinary care that has been shown to reduce the number of amputations. It is easily

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reproducible and has been developed as a successful model of care throughout the world. This system is always being improved and refined, and this book describes the modern version of our diabetic foot management.

One important facet of this approach is the realization that neuropathy revolutionizes the practice of medicine and surgery. Classical symptoms and signs of disease are often absent because their expression depends on an intact peripheral nervous system. Thus, in traditional medical practice, a patient has a symptom, complains of this to their practitioner, who then makes a diagnosis. However, this approach may not work in the patient who has neuropathy. Instead, there must be a meticulous assessment of the patient to elicit subtle symptoms and signs that are clues to disease. Furthermore, an intact nervous system usually reflects symptomatically a 'picture' of what is going on inside the body, but in the presence of neuropathy this picture is absent and prompt use of imaging is required. Also, particular attention must be paid to inflammatory markers. Overall, it is important to practise what we call 'neuropathic medicine'. All practitioners looking after diabetic feet should understand this and adapt their practice of working with diabetic foot patients.

MODERN MANAGEMENT OF THE DIABETIC FOOT

This consists of four simple steps: assessment, classification, staging and intervention.

Assessment

A simple assessment of the diabetic foot is described to classify and stage the foot, looking for eight clinical features (Table 1.1). This assessment should take no longer than 5 min.

Table 1.1 Eight clinical features in the assessment of the foot.

Neuropathy
Ischaemia
Deformity
Callus
Swelling
Skin breakdown
Infection
Necrosis

Classification

The diabetic foot can be classified into two groups:

1. Neuropathic foot with palpable pulses
2. Ischaemic foot without pulses and a varying degree of neuropathy.

The neuropathic foot may be further divided into two clinical scenarios:

1. Foot with neuropathic ulceration
2. Charcot foot, which may be secondarily complicated by ulceration.

The ischaemic foot may be divided into four clinical scenarios:

1. Neuroischaemic foot characterized by both ischaemia and neuropathy and complicated by ulcer
2. Critically ischaemic foot
3. Acutely ischaemic foot
4. Renal ischaemic foot characterized by digital necrosis.

Fig. 1.1 The natural history and staging of the neuropathic and ischaemic foot.