

Handbook of Foot and Ankle Orthopedics

Rajiv Shah



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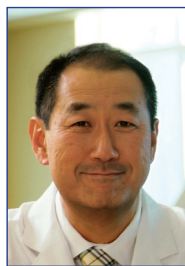
This book is dedicated to my dearest wife Dr Bina Shah
whose love, support and tolerance nurtured this book!

Rajiv Shah

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Foreword

"Education is the most powerful weapon which you can use to change the world."

—Nelson Mandela

India is in the midst of one of the most rapidly changing environments in health care history. With almost 1.3 billion people today and expected to exceed China's population shortly, India spent almost US \$78 billion in health care in 2012 and this is projected to exceed US \$280 billion by 2020. Diabetes is one of the most rapidly rising disease conditions in India, growing at a rate of almost 8% of the population. But because of poor access to primary care physicians and data collection, it is estimated that the rate of diabetes in the country may grow to almost 30%. India also has one of the fastest-growing segments of people aged over 65 years and with degenerative arthritis. And due to very high motor vehicle accident rates and industrial accidents, posttraumatic deformities approach epidemic rates here.

These are formidable times for an orthopedic surgeon in India.

This brilliant handbook written by Dr Rajiv Shah, MS, helps make sense of an overwhelming environment. Rather than running away from the most difficult diabetic foot condition or the worst of a traumatic deformity, the lone orthopedic surgeon can now analyze almost every common foot and ankle condition with logic and reason. With this handbook, the surgeon will get help in identifying common conditions, avoiding frequent mistakes, and imparting a degree of confidence to their patients as they grow within the field of specialized foot and ankle surgery.

The need for this knowledge is pressing. Treated accurately, diabetes and infection can result in limb salvage instead of amputation. Complex deformity can be treated with precise osteotomies if they are recognized in the correct plane and the patient will be returned to an active lifestyle.

As the surgeon's interest in foot and ankle grows, this elegant handbook even guides the reader to building their own specialized practice. Impressively, the book has almost a full year's fellowship within its covers!

As the world of orthopedic surgery changes in developing countries, this handbook will be a valuable guide for all surgeons to learn the art and science of foot and ankle surgery.

Thomas H. Lee, MD,
Vice President,
American Orthopedic Foot and Ankle Society,
United States



Foreword

Dr Rajiv Shah has established himself as an eminent foot and ankle surgeon and a respected educator in the field. He has the expertise to analyze and explain foot and ankle surgery in a precise, simple-to-follow and easy-to-remember way.

This handbook is a must-have, quick reference resource for trainees and practicing orthopedic surgeons who are evaluating patients with foot and ankle problems. Dr Shah has consolidated all essential facts about foot and ankle management in this to help orthopedicians evaluate and care for the patients better.

Selene G. Parekh, MD, MBA,
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Preface

Nine years ago, when I specialized to become the first foot and ankle surgeon of India, I realized that there is a lack of availability of foot and ankle literature as well as expert guidance in the field in our country. I had to heavily rely on Western literature and experts for my guidance and training. What makes practicing foot and ankle orthopedics in developing countries more challenging is the large number of untreated or poorly treated cases, quite a few of whom suffer utter neglect even at the hands of medical practitioners.

The most pressing problems for practicing foot and ankle orthopedicians are lack of resources and nonavailability of equipment, instruments, and implants. These hurdles are further compounded by the financial limitations of patients. In this context, applying Western solutions to indigenous problems led to failures and I had to face many difficulties initially. Gradually, I realized that solutions for our problems have to emerge out of our own innovations and experiences. Doing that was a challenge and I accepted it as a mission.

This work is a step forward in that mission.

This handbook discusses every aspect of foot and ankle orthopedic problems in a concise yet comprehensive manner. In order to serve as a ready reckoner for orthopedic surgeons, it has its content organized in a point-wise format, supported by algorithms, tables, illustrations and real clinical pictures. It offers implementable solutions to both common and complex foot and ankle problems suggested by authors of international repute.

I am certain that this handbook will have a unique and significant place in the armamentarium of every practicing orthopedic surgeon, and it will facilitate the growth of foot and ankle orthopedics as a separate subspecialty of orthopedics in developing countries.

Rajiv Shah

Acknowledgments

This book is a consequence of extensive efforts, both direct and indirect, of many individuals. I would like to recognize and thank them for their significant contributions.

I have been honored by the contributions made to the book by legends in the field like Dr Arun Bal, Dr Vikas Agashe, Dr Ravi Mahajan, and Dr Milind Chaudhary. Notwithstanding hectic work routines, each of their chapters is an extremely sincere effort and would impart invaluable learning to practitioners in the field.

Dr Selene Parekh, Dr Thomas H. Lee, Dr Ashish Shah, Dr G. S. Kulkarni, Dr Mandeep Dhillon, Dr Vinod Panchbhavi, Dr Sudhir Babhulkar, and Dr Hariharan have always been my mentors and source of inspiration. This book is also a result of their influences in no uncertain terms.

Dr Bhikhubhai Patel, Dr Tushar Shah, Dr Nikesh Shah, Dr Jayesh Solanki, Dr Jaykrishna Mekhiya, Dr Suresh Rathwa, and Dr Vakhat Parmar have helped me tremendously by sharing my work obligations cheerfully. It would have been very difficult for me to work on this book without their cooperation.

Last but not the least, I can never have appropriate expressions to thank my family and my patients for their unflinching support and confidence in me.

Rajiv Shah

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Chapter 1

Foot and Ankle Examination

Foot and ankle examination means rule of three!

Precise clinical examination of foot and ankle is the first step toward successful treatment of foot and ankle ailments. Three important rules to be followed by the examiner are listed in **Box 1.1**.

Box 1.1 Rules for the examiner.

- ◆ Gait examination
- ◆ Foot and ankle examination
- ◆ Footwear examination

Similarly, there are three important rules to be followed by the patient for proper evaluation, which would allow the examiner to interpret the condition of the disease correctly. Three important rules meant for the patient are listed in **Box 1.2**.

Box 1.2 Rules for the patient.

- ◆ Enters walking
- ◆ Enters with footwear
- ◆ Enters with trousers up

Gait Examination

For proper examination of the gait, the following points are to be observed:

- ◆ Symmetry of parts
- ◆ Toe versus patella position
- ◆ In or out toeing
- ◆ Arches
- ◆ Foot posture and position
- ◆ Heel posture and position
- ◆ Type of gait

Foot and Ankle Examination

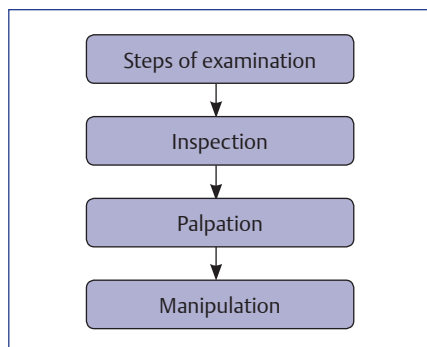
Examination should be performed in three positions. **Box 1.3** illustrates the three rules for patient's positions during examination. Examination of the foot is divided into three parts (**Box 1.4**) and is performed in three basic steps, which are listed in **Flowchart 1.1**.

Box 1.3 Rules for patient's positioning during examination.

- ◆ Examination while walking
- ◆ Examination while standing
- ◆ Examination while sitting

Box 1.4 Parts of examination of the foot.

- ◆ Ankle and hindfoot examination
- ◆ Midfoot examination
- ◆ Forefoot examination



Flowchart 1.1 Steps of examination.

Inspection

Consider the following while inspecting foot and ankle:

- ◆ Alignment and position of foot with respect to ankle as well as alignment of ankle and foot with respect to leg, knee, and hip
- ◆ Shape and size of the foot
- ◆ Deformities, deviations, and prominences
- ◆ Skin
- ◆ Callosities and corns
- ◆ Varicosities
- ◆ Nails and hair

Palpation

Palpation is done by using the index finger, either self or that of the patient (**Fig. 1.1**), beginning sequentially from the medial aspect to the plantar, to the lateral, followed by the anterior, and finally ending at the posterior aspect.

The three important parts of palpation are mentioned in **Box 1.5**.

For the right foot, start clockwise, and for the left foot start anticlockwise (**Figs. 1.2 and 1.3**).



Fig. 1.1 Patient pointing at the painful area with his index finger.

Box 1.5 Parts of palpation.

- ◆ Topographical palpation
- ◆ Neurological palpation
- ◆ Vascular palpation

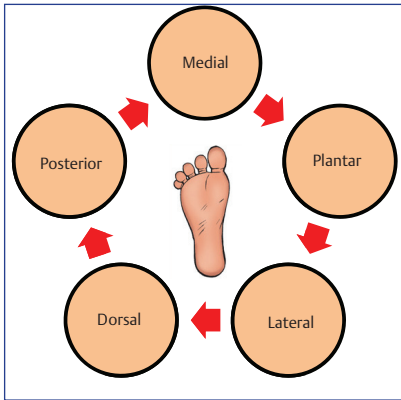


Fig. 1.2 Palpation of the right foot.

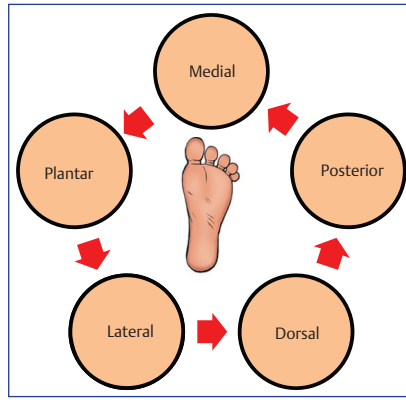


Fig. 1.3 Palpation of the left foot.

Topographical Palpation

Structures to be palpated in sequence are as follows:

- ◆ Skin
- ◆ Bone and joints
- ◆ Ligaments
- ◆ Muscles and tendons
- ◆ Arches

Topographical palpation areas of (1) ankle are depicted in **Figs. 1.4** to **1.8** and are described in **Table 1.1**; (2) midfoot are depicted in **Figs. 1.9** and **1.10** and are described

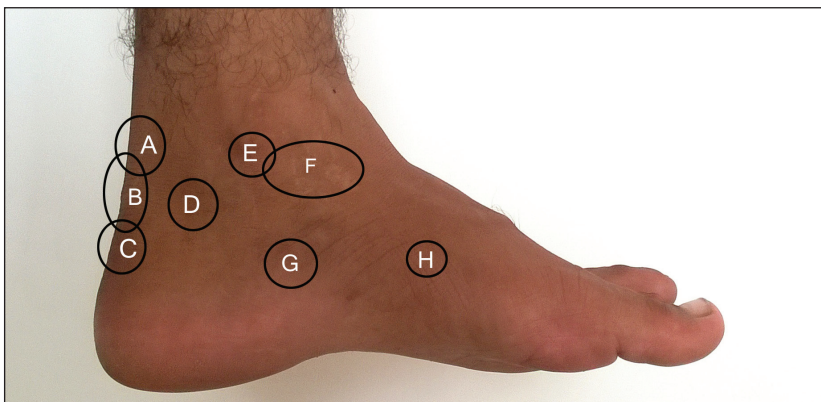


Fig. 1.4 Medial aspect of the foot and ankle. A, Achilles rupture/noninsertional tendonitis; B, insertional Achilles tendonitis; C, calcaneal apophysitis/pump bump; D, retrocalcaneal bursitis; E, tarsal tunnel syndrome/ tibial posterior tendon; F, medial/deltoid ankle sprain; G, entrapment of first branch of lateral plantar nerve; H, accessory navicular/master knot of Henry/medial plantar nerve entrapment.



Fig. 1.5 Plantar aspect of the foot. A, plantar fasciitis; B, fat pad atrophy.

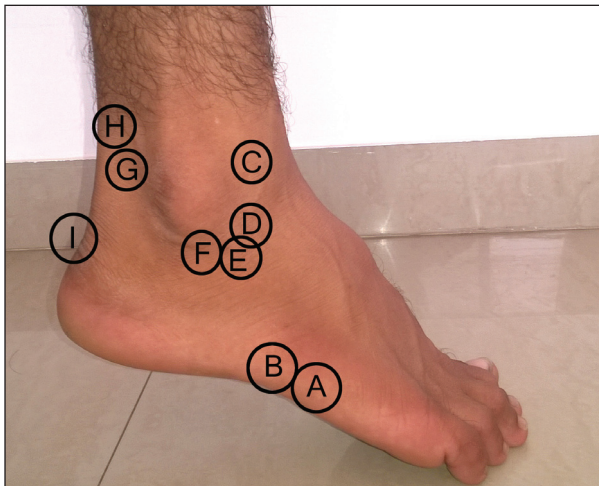


Fig. 1.6 Lateral aspect of the foot and ankle. A, Jones fracture; B, avulsion fracture of the fifth metatarsal; C, anterior ankle impingement; D, anterior talofibular ligament; E, sinus tarsi syndrome; F, calcaneofibular ligament; G, retrocalcaneal bursitis; H, Achilles tendonitis; I, calcaneal apophysitis/Sever's disease/pump bump.



Fig. 1.7 Anterior (dorsal) aspect of the foot and ankle. A, anterior ankle impingement; B, osteochondral defect of talar dome medial or lateral; C, the n spot: navicular stress fracture.

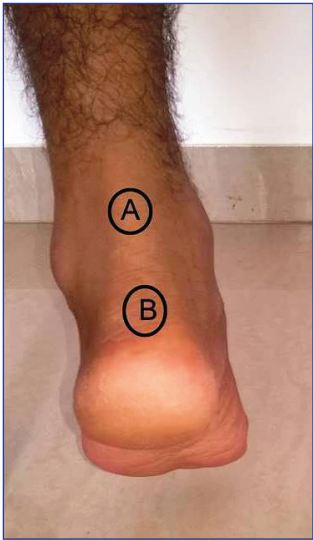


Fig. 1.8 Posterior aspect of the foot and ankle. A, tendo Achilles; B, insertion of tendo Achilles.

Table 1.1 Areas for topographical palpation of ankle

Medial	Plantar	Lateral	Anterior	Posterior
Medial malleolus	Abductor hallucis	Tip of fibula	Tibialis anterior	Achilles tendon
Medial joint line	Plantar fascia	Shaft of fibula	Extensor hallucis longus	Insertion of Achilles
Medial gutter	Abductor digiti minimi	Lateral gutter of ankle	Extensor digitorum longus	Retrocalcaneal
Navicular	Fat pad	Syndesmosis	Tibia	
Talar head		Lateral wall of calcaneus	Talus dome	
Tibialis posterior		Peroneal tubercle	Superficial peroneal nerve	
Flexor digitorum longus		Sinus tarsi	Peroneus tertius	
Flexor hallucis longus		Extensor digitorum brevis	Ankle joint	
Posterior tibial artery		Lateral talar process		
Sustentaculum tali		Peroneal tendons		
Deltoid ligament		Anterior talofibular ligament		
Medial tibia		Calcaneofibular ligament		
Medial talus		Sural nerve		

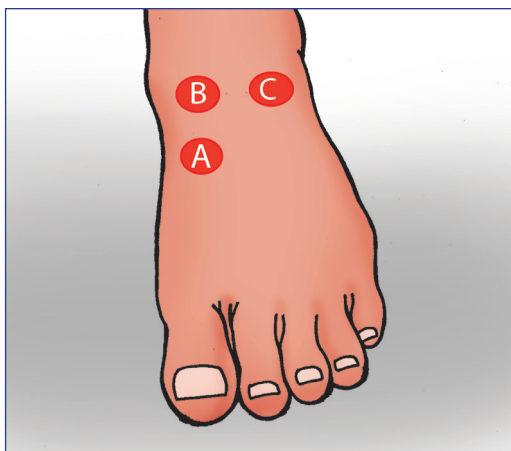
**Fig. 1.9** Dorsum of the midfoot. A, naviculo-cuneiform joint; B, talo-navicular joint; C, calcaneo-cuboid joint.



Fig. 1.10 Plantar aspect of the midfoot. A, plantar fascia.

in **Table 1.2**; (3) forefoot are depicted in **Figs. 1.11** and **1.12** and are described in **Table 1.3**.

Table 1.2 Areas for topographical palpation of midfoot

Dorsal	Plantar
Talonavicular joint	Plantar fascia
Calcaneocuboid joint	
Naviculocuneiform joint	
Base of first metatarsal	
Bases of second, third, and fourth metatarsals	
Base of fifth metatarsal	
Insertion of tendon of tibialis posterior	
Insertion of tendon of tibialis anterior	
Insertion of tendon of peroneus brevis	

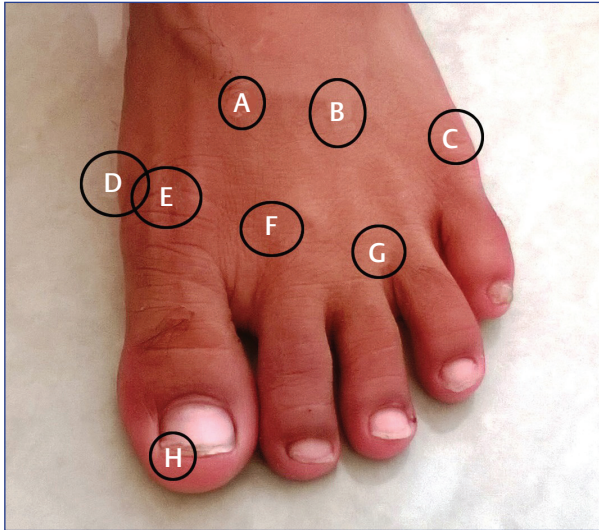


Fig. 1.11 Dorsum of the forefoot. A, lisfranc sprain; B, anterior tarsal tunnel syndrome; C, bunionette; D, bunion/gout; E, hallux rigidus; F, Freiberg infarction; G, Morton neuroma; H, paronychia.

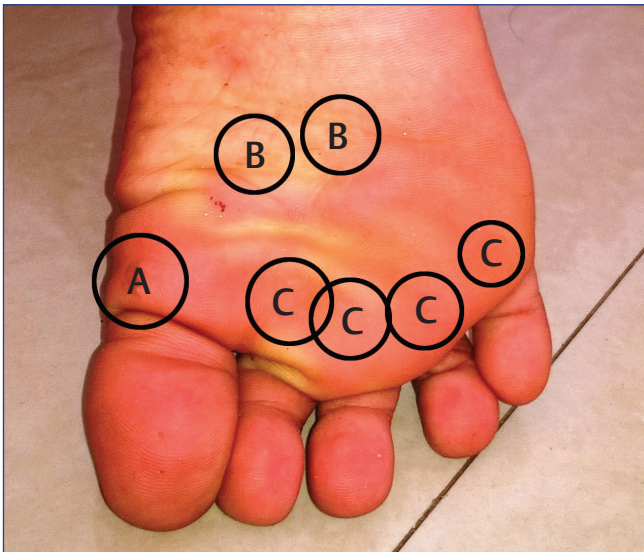


Fig. 1.12 Plantar aspect of forefoot. A, sesamoiditis/stress fracture/sports injury; B, stress fractures of metatarsals; C, metatarsalgia.

Table 1.3 Areas for topographical palpation of forefoot

Hallux	Lesser toes
Head of first metatarsal	Metatarsal shafts
Medial sesamoid	Head of metatarsals
Lateral sesamoid	Metatarsophalangeal joints
Dorsalis pedis artery	Extensor digitorum longus
Extensor hallucis longus	Flexor digitorum longus
Extensor digitorum brevis	
Metatarsophalangeal joint	
Flexor hallucis longus	

Neurological Palpation

Nerve supply of foot is shown in **Figs. 1.13** and **1.14**. Neurological palpation includes testing of the following elements:

- ◆ Sensations
- ◆ Reflexes
- ◆ Motor strength
- ◆ Monofilament testing

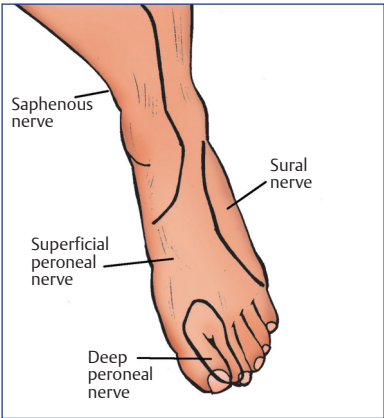


Fig. 1.13 Pattern of nerve supply on the dorsal aspect of the foot.

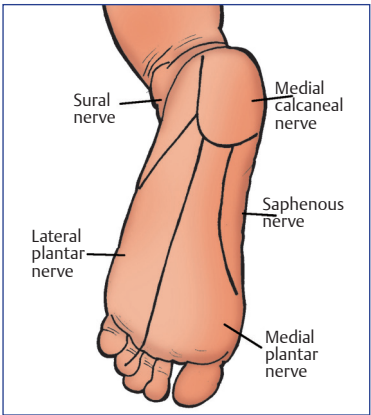


Fig. 1.14 Pattern of nerve supply on the plantar aspect of the foot.

Vascular Palpation

This includes examination of the following:

- ◆ Dorsalis pedis artery
- ◆ Posterior tibial artery
- ◆ Nail bed circulation

Manipulation

Both active and passive manipulations are important!

The following are manipulated:

- ◆ Joints
- ◆ Pulses
- ◆ Neurological examination includes sensations, power, and reflexes
- ◆ Motor examination includes tone, tightness, snapping, tenderness, fullness, and strength of every muscle of foot and ankle
- ◆ Plantar fascia
- ◆ Arches
- ◆ Deformities and correctability

Footwear Examination

This includes examination of the following:

- ◆ Wear and sites of wear
- ◆ Creases
- ◆ Size and shape
- ◆ Laces
- ◆ Heel and heel counter
- ◆ Forefoot impression
- ◆ Shoe versus foot shape
- ◆ Flexion test (**Fig. 1.15**)
- ◆ Torsion test (**Fig. 1.16**)



Fig. 1.15 Grossly flexible and deformed footwear on flexion test.



Fig. 1.16 Torsion test. Grossly deformed footwear on twisting front portion over the back portion of footwear.

- ◆ **Orthosis examination:** Look for the type of orthosis. Fitting of orthosis in the footwear and precise positioning of offloading by orthosis over and above wear and tear of orthosis should be noted (**Fig. 1.17**).

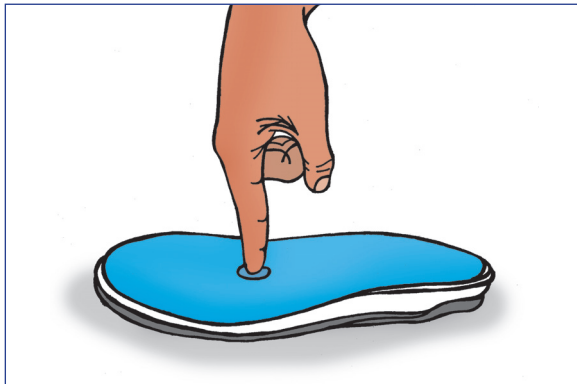


Fig. 1.17 Orthotic examination.

Examination while Standing

The following points are to be carefully observed in foot and ankle in the standing position:

- ◆ Arches
- ◆ In toeing/out toeing