

**SAVE FOOT  
IN DIABETES**

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# SAVE FOOT IN DIABETES

## Authors

Dr. Vibhakar Vachhrajani  
Mrs. Kalyani Vibhakar Vachhrajani  
Dr. Payal Khakhkhar

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Nr. Jain derasar, Gandhi road, Ahmedabad-380 001  
(079) 2213 9253, 2213 2921

✉ [info@navbharatonline.com](mailto:info@navbharatonline.com) [www.navbharatonline.com](http://www.navbharatonline.com)

[fb.com/NavbharatSahityaMandir](https://www.facebook.com/NavbharatSahityaMandir)

## **SAVE FOOT IN DIABATES**

### *Written by:*

Dr. Vibhakar Vachhrajani  
Mrs. Kalyani Vibhakar Vachhrajani  
Dr. Payal Khakhkhar

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✉ info@navbharatonline.com

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# **Dedicated to Two Great Teachers**



**Late Shri Rasikray  
Tulajashankar Vachhrajani**



**Late Shri Madhukar  
Jaswantray Anjaria**

and

To,



**Sri Sri Ravi Shankarji**  
(Our Spiritual Guru)

# Gratitude

While writing a book in English for doctors about healing wounds and dressing, the idea of writing this book struck, that could be useful to the patients of diabetes. All the staff members of my hospital helped me in my work by gathering information about the patients and photos. After the first edition of Gujarati book, there was a demand for English book. We requested our friend Mr. Parth Joshi for translation. The Christ college team of English department helped us to do translation of our Gujarati book. We thank them for their kind help.

We heartily thank all the staff members of the hospital, family members, friends and the patients.

**Dr. Vibhakar Vachhrajani**

# Acknowledgement to the translators

We are incredibly grateful to the following team members from the **Dept. of English, Christ College, Rajkot**, for their valuable contribution in translating, editing and proofreading the English draft very meticulously:

Dr. Tisha Roy (HOD, Dept. of English)  
Mr. Parth Joshi (Asst. Prof, Dept. of English)  
Mr. Aanay Bhatt (Undergraduate Student)  
Mr. Milind Bosamiya (Undergraduate Student)  
Ms. Priya Pandya (Undergraduate Student)  
Ms. Suhani Sorathiya (Undergraduate Student)  
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We sincerely acknowledge and appreciate their effort.

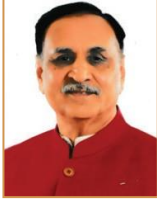
**Dr. Vibhakar Vachhrajani**

**Smt. Kalyani Vachhrajani**

**Dr. Payal Khakhkar**







**Vijay Rupani**  
Chief Minister, Gujarat

Apro/jm/2019/09/23/vj

Date: 23-09-2019

**Dear Dr. Vibhakar, Mrs. Kalyani and Dr. Payal,**

Congratulations.

I am glad to know about this book, coming out from the essence of years of experience that the authorial team - a confluence of medical profession, education and service - possesses.

The book, with its motivating title and directive points, has eased the pathway for diabetics to win the battle of life.

With the hope that people victoriously combat the silent killer named diabetes through careful lifestyle and seriousness with manifold usefulness.

(Vijay Rupani)

## Authors' Introduction



### Dr. Vibhakar Vachhrajani

Son and son-in-law of a teacher, Dr. Vibhakar Vachhrajani has been serving as a surgeon for 32 years. After obtaining his M.B.B.S and M.S. from M.P. Shah Medical College, Jamnagar, he worked as a Full time surgeon and an assistant professor at Government Hospitals of Chotila and Surat respectively, contributing towards the development of student s. Thereafter, he made Rajkot - his *karmabhoomi*, serving as a full-time surgeon at H.J. Doshi Hospital, Rajkot. Since 1991, he possesses his own surgical hospital in Rajkot.

After the year 2002, he found himself interested in the treatment of diabetic foot and non- healing wounds. This led him to leave all the other operations and surgeries and focus mainly on treatment of non-healing wounds in diabetes. For this, he got trained under his *guru* Dr. Arun Bal from Raheja Hospital, Mumbai. For further studies in the area, he went to King's College, London, Lutheran General Hospital and Dr. William M. Scholl College of Podiatric Medicine, Chicago, America.

As a part of social service, he conducted lectures for doctors as well as the patients in more than 100 villages and cities. He has also delivered lectures at several medical conferences of

national and international levels. He has also published a book "Science of wound healing and dressing material" for doctors and wound care professionals.

The sole purpose of writing this book is to prevent the number of leg amputations that occur in diabetic patients as a result of lack of knowledge so that they can lead a good life. In the last 20 years, Dr. Vachhrajani has been able to cure over 50000 patients with problems in leg. Dr. Vachhrajani, basically a teacher at core of his heart, thought of writing the book to educate the society.

It would be a major service to people if the diabetic patients and their family members read this book and recommend it to others.

**Vijay Vachhrajani Memorial  
Diabetic Foot Hospital**

13/3 Jagnath Plot, behind Kathiawar Gymkhana,  
Yagnik Road, Rajkot - 360 001, Gujarat, India  
Phone no. 0281-2460733, 2480599, 2461755,  
Whatsapp no. 6353236895  
E-mail: vibhakar1@gmail.com  
Website: [diabeticfootsurgeongujarat.com](http://diabeticfootsurgeongujarat.com)



## **Mrs. Kalyani Vibhakar Vachhrajani**

Mrs. Kalyani Vibhakar Vachhrajani also was born to a teacher father. After completing her higher secondary education from Navjivan Girls' High School, Dahod, she completed her graduation in science from the same city and her B.Ed from Godhra, Gujarat. She served as a science teacher in her alma mater, Navjivan Girls' High School.

A teacher at heart, she thus got the opportunity to teach science to many students.

Mrs. Vachhrajani won the hearts and trust of many students by running advanced centre of Science at Kadvibai Virani Kanya Vidhyalaya, a renowned school in Rajkot. In order to help her husband (Dr. Vibhakar Vachhrajani) in educating the patients at the hospital, she undertook a one year course of diabetic counsellor from Madras's (Chennai) famous institution called V.Mohan's Institute of Diabetes. Along with that, she also underwent training for diabetes counselling under Rajkot's well-known physician and diabetologist Dr. Vidyut Shah. For last ten years, she has been counselling the patients coming to Dr. Vibhakar's hospital about diabetes, food, exercises, and other social and family issues, thus trying to help them win over their troubles.

Five years ago, she published a book in the form of frequently asked questions on diabetes along with their answers, which was titled '*Chatt Sava/ Patt Javab*'

Through the present book, she has made an effort in collaboration with Dr. Vibhakar Vachhrajani and Dr. Payal Khakhkhar, to help and educate as many people as possible.



## **D PayalKhakhkhar**

Dr. Payal Khakhkhar started her educational journey from a small village near Rajkot and completed her schooling under the Gyanprabodhini Project (run by Shri Vijay Rupani). She received special scholarship during her study.

She completed her graduation in Homeopathy Medicines from Dangar Medical College, Rajkot, with flying colours, followed by serving at various Government Hospitals and private hospitals. For last eight years, she has been working at Dr. Vachhrajani's hospital and has served for several diabetes camps.

Dr. Khakhkhar also took a one year course for Diabetes Educator from Chennai's prestigious institution V. Mohan's Institute of Diabetes. She has also published a book "Science of wound healing and dressing material" for doctors and wound care professionals.

Along with helping during the operations, Dr. Payal Khakhkhar also looks after the treatment of the patients and also serves as a guiding light for them. Working incessantly is her nature. Hers, is a great contribution in collaboration with Dr. Vibhakar and Mrs. Kalyani in offering this book to the society.

## Reviews



Though feet are lowermost parts of our body, they help us stand and walk, and connect us to the earth. If a patient faces issues like infection in foot, gangrene, wounds etc it can be called 'foot attack' just like a heart attack. This foot attack may result into some serious illness or even death.

Diabetes adds fuel to this fire. The bitter truth is that there are many diabetic patients, who have to get one or two legs amputated.

There are very few doctors who really understand the diabetic foot and treat them correctly. In such circumstances, Dr. Vibhakar Vachhrajani has dedicated his whole life to the treatment of foot patients. It's no surprise that his hospital is called '*Temple of foot*'

It's quite welcoming to get a book informing about the diseases related to foot and diabetes in the simplest language from the priest of this temple himself.

With all the good luck, may the people in general benefit out of this book and help in fulfilling the purpose of this book.

**Dr. Vidyut Shah**



This book, written on the foot problems in diabetes, can be useful for diabetic patients. From the anatomy of the leg to diagnosis and its treatment, this book contains everything in the simplest language. Patients, often, aren't aware about the symptoms and the various treatments about certain diseases.

The damage caused by smoking and other addictions to different organs, are also clearly mentioned. It is false that the wounds in diabetes do not heal and people use unscientific methods for treatment. Such false beliefs lead to more serious issues and amputation of leg in severe cases.

This book gives detailed information about the principles of treatment of diabetic foot, taking care of foot/leg after surgery, precautions to keep the leg healthy and safe etc. Diabetic patients should not consider wearing footwear as a burden. They only need to be aware of how to wear them. The speciality of this book is that it contains pictures for a better understanding.

I congratulate Dr. Vibhakar Vachhrajani, Mrs. Kalyani Vachhrajani and Dr. Payal Khakhkhar and believe that this book will be of great help to the people suffering from diabetes to save their feet.

**Dr. Banshi Saboo**

## **A Request - *Pustak Parab***

This book is for educating diabetic patients and everyone who has a diabetic patient at home . As many patients it can be reached, the pain and leg-amputation of so many patients can be prevented. Therefore, it is a humble request that after reading this book, it be given to one more diabetic patient. The last few pages of this book have been left blank with an intention that those who have read the book can write their names there, sign and circulate it among others.



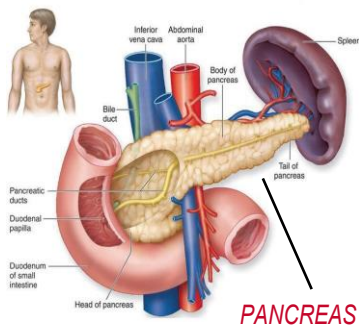
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## FOOT AILMENTS IN DIABETES - A PROBLEM

Diabetes is characterized by abnormally high glucose level in the blood. There may or may not be presence of glucose in the urine. Pancreas, an elongated feather shaped gland located near left kidney and spleen in the left side of the abdominal cavity of our body, is responsible for the formation of insulin. Diabetes may result due to the inefficient production of insulin by pancreas.



Diabetes can also be hereditary. Factors such as obesity, mental stress, imbalanced eating habits, lack of exercise, sedentary lifestyle, etc. invite diabetes. Diabetes occurring in children is not hereditary but due to the harm caused to the beta cells of

pancreas by virus infection. Usually, foot problems in diabetes begin after 5-10 years. It may happen that a patient is suffering from diabetes but it may remain undetected for many years. Sometimes when there is foot infection or pus, for any other diseases, the doctor advises a blood report through which diabetes is diagnosed accidentally. According to an estimate, a

person walks for about 1.5 lakh kilometres during his lifespan, it equals to walking around the earth for four times.

It is quite difficult to get the correct figures of diabetic patients in India since all the patients are not recorded in the government records. However, according to one estimate, there were around 3 crore 20 lakh diabetes patients in 2005 which may increase to 5 crore 70 lakh in 2025. There will be more than 30 crore diabetes patients, according to another estimate, all around the world by the year 2025 and a large portion of it will be people from developing countries like India. Increase in amount of diabetes patients is not just found in only urban areas but, in rural areas too.



*Wound in foot*

According to one estimate, around 15% of diabetics suffer from foot ulcerations/foot wounds. This condition might reach to bones in around 15% of such patients and out of those, 15% might also need to get their leg amputated.

90% of diabetic patients suffer from type-2 diabetes. Paediatric patients of diabetes (juvenile diabetes) are quite less. There are around 1200 recorded cases of diabetic children in Rajkot city till 2020.

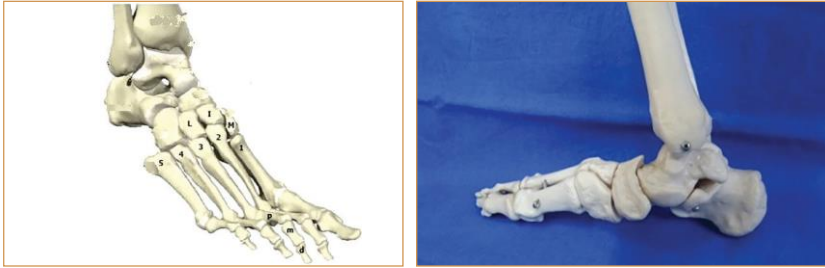
30-40% people in India suffer from leg problem due to nerve damage and around 20-30% people suffer due to narrowing of blood vessels.

80% of the people, who had to get their leg amputated, have diabetes. Many a time, the foot ulcers take a long time to heal. Around 8% of patients need time period of 6-18 months for wounds to heal.

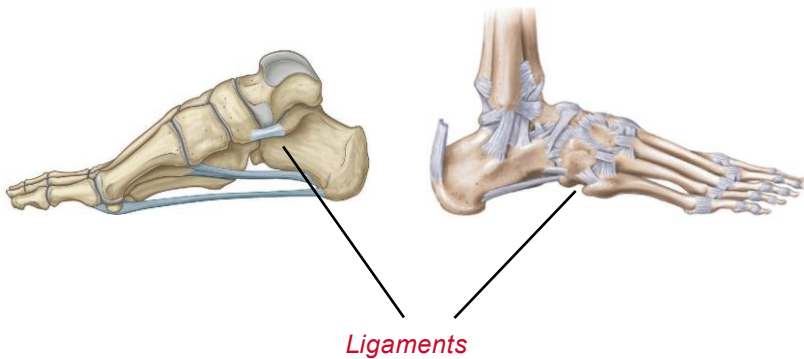
It is assumed that if a patient suffers from foot ulcer once, the chances of it happening again(recurrence) in the next four years are 100%.

The cost increases quite a lot for the patient suffering from leg problem. It becomes a liability for the society or family and since it creates problem in the job or business, the income reduces. Thus, what would be wise is to prevent the leg ailments and factors leading to it, such as nerve problem, narrowing of blood vessels, injury. If consumption of tobacco, cigarette and alcohol is stopped, then diabetic patients can reduce the burden on themselves, society and family . ■

## ANATOMY OF FOOT



*Structure of bones and joints of foot*



A foot is made up of 26 small bones, 29 joints and 42 muscles. It is quite fascinating what the function of so many bones, joints, and muscles would be. Think, if our foot was made up of one or two bones, then the problem while walking would be equivalent to that felt while wearing wooden footwear. These bones and joints are small so as to facilitate various kinds of

movements on high, low or uneven land, in a pit, on a hill, through pebbles and sand, and on different kinds of surfaces. All the muscles and joints are responsible for it.

Imagine a door. The hinges on it move only in one direction. But the joints of our shoulders can move in multiple directions. Though the joints in our fingers can move in one direction, the joints of the wrist can move in many directions. In the same way, the joints in our feet can move in various directions and that is the reason we can walk.

The role of the numerous protein fibres called ligaments is to keep these joints together, so that they do not get dislocated, by allowing certain movements.

There are 42 muscles responsible for all these bones and joints to work. This mechanism is no less than that of a super-computer.



*Media/arch*

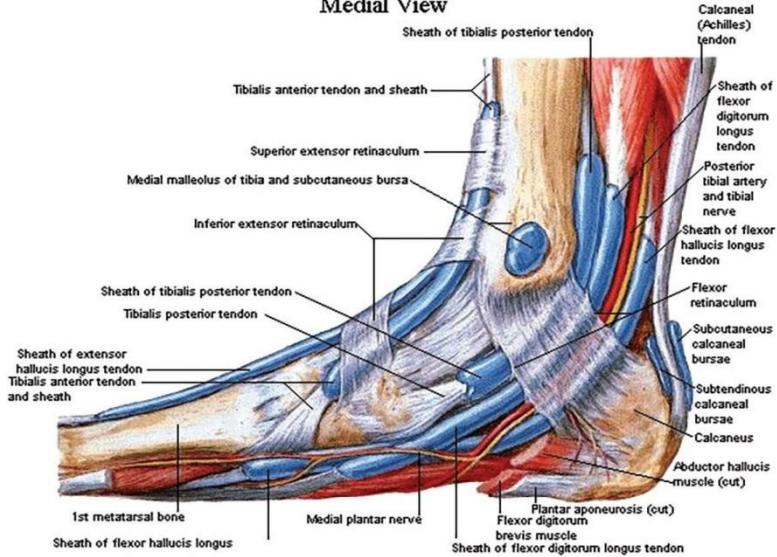
The structure of the bones and joints in the foot is such that it forms an arch in the sole which helps with the movements.

For smooth movements of the muscles of the leg and foot, there is a sticky liquid present in the tube wrapped around

tendons which helps tendon to work properly throughout life without any need for oiling.

## Tendon Sheaths of Ankle

### Medial View

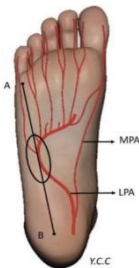


Blue coloured tubes containing oily fluid through which the tendons of muscles pass

There are two types of blood vessels present in the foot: Arteries bring pure blood and veins take impure blood to the lungs and the heart. Our body's creation is so incredible that in spite of

the pressure applied on feet while walking, or the weight of the person's body, blood vessels keep on working.

A foot has lymphatic vessels in the same way that it has blood vessels.



*Arteries*

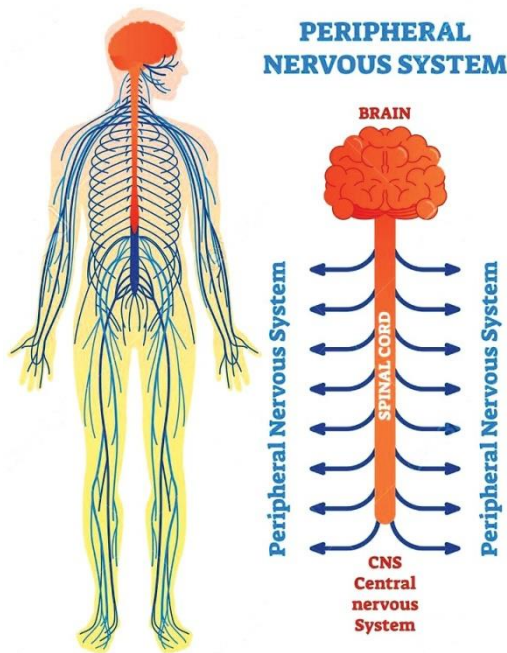


*Veins*



From the brain through the spinal cord, the nerves along with the vessels enter the foot and help the movements and in controlling the sensations such as awareness of hot and cold surfaces, touch, piercing from pointed things, etc.

Longer the nerves are from the brain, more the damage caused to them due to diabetes . The nerves from the brain also control the activities of the muscles as well as the sweat glands along with the sensations. The damage caused to these nerves in a patient can lead to frequent fall while walking, imbalance while standing, and the fear of falling.



*Distribution of nerves from brain up to the foot through spinal cord.*



*Flat foot*



*Deformed foot*

Due to the dislocation of some bones and joints, many patients suffer from flat foot as well as deformed foot. ■

## METHODS OF FOOT EXAMINATION

First of all, the patient should have the habit of self-checking his feet. He should examine daily sole of the feet, nails, and the gap between the toes. The patient who suffers from joint pain can make use of a mirror to check-up his soles. Those patients who suffer from vision problems can ask their family members or friends to check the feet every day.

Even if there is no problem, a patient should, at least once a year, get his leg checked by an expert. When there has been any surgery performed on the leg or foot, a check-up is necessary every three or six months.



*Foot examination with the help of a mirror*

### **Foot Check-up by a doctor**

Whenever a patient visits a doctor for a check-up, the socks and shoes, along with the two feet, are examined.

Swelling on the feet, hammer toe, gap between the toes, nails, skin colour, cuts and cracks, etc. are checked.

Along with that, the temperature of the foot, the pulsations of the foot, pain in any area of the foot when touched, softness or hardness of the skin, finding crepitus by applying pressure to the skin, movements of the joints of the leg, etc. are also checked.



If there is a sound of a bubble bursting in any part of the skin while applying pressure (Crepitus), the presence of pus or poisonous gas is possible. If there is less toe movement, it indicates the stiffening of joints.

*Deformed feet*



*Examination of pulsation to check blood supply*

After all this, the doctor takes help of various equipment for checking the feet.

### Monofilament - checking the foot with a wire



*Monofilament*



*Tuning fork*

A wire termed Monofilament is useful for the diagnosis of neural problems in the foot. The presence or absence of sensations, while the wire is touched to different parts of the foot, is recorded.

A Sensitometer or Biothesiometer is used for further diagnosis in patient s with neural problems. It records the patient's reaction to heat and cold, vibration. If there is any patient suffering from neural damage, this machine diagnoses it.



*Biothesiometer*

## Doppler Test

Doppler is a machine which gives information about the blood circulation. It shows whether the blood circulates properly along with the pulse. The B.P. of the forearm and that of the ankle is different. The index of this B.P. is given below:



*Doppler*

$$\text{Ankle Brachial Index} = \frac{\text{Ankle B.P.}}{\text{Arm B.P.}}$$

ABI = Ankle Brachial Index is found by dividing the ankle B.P. with the arm B.P. It normally is between 0.7 and 1.3.

E.g.

$$\text{Ankle Brachial Index} = \frac{\text{Ankle B.P.}}{\text{Arm B.P.}} = \frac{140}{120} = 1.16$$

(The ankle has the blood pressure of 140mm Hg, and the arm has 120mm Hg)

There will be a difference in the index when the blood vessels of the leg are damaged. If there is any blockage in the vessel, then the index falls down. If there is hardening in the walls of the vessel due to deposition of calcium, the index rises. Both rise and fall of the index indicate less circulation of blood.

There are two types of Doppler: **Simple Doppler** shows the blood circulation of the patient's leg. The **Colour Doppler** shows a more detailed picture of the blood vessels and with

this, it is easier to learn whether there is blood clot in vein or artery.

### **Importance of blood report in leg diseases**

Along with the diabetes report, there are many other reports a diabetic foot patient needs to get done, like the proportion of infection in the leg, its effect on blood, functioning of kidney, percentage of haemoglobin in the blood and functioning of the liver. Just a blood sugar report is not enough for the treatment of infection in the leg.

### **Pus Culture Sensitivity Report**

A sterilized stick is used by the doctor to take pus from the infected part of the leg and sent to the laboratory. In the laboratory, when this pus is put in a special bowl, bacteria grow from it. Many antibiotic medicines are applied to these bacteria to determine which medicine is the most effective for its destruction. That particular medicine is given to the patient for effective recovery. This method is called Culture Sensitivity Report.

### **X-ray**

The damage caused to the bones of the foot and leg by the bacteria is not visible to the naked eye. Thus, it is necessary to get an X-ray. It is more important to get an X-ray if the wound takes more than 6 weeks to heal.



*X-ray of normal foot*

Charcot foot is a condition of weakening/destruction of the bones in the foot enough to dislocate or fracture. Sometimes, a wound is not present on the swollen foot but still, it is advised to get an X-ray for the reason that a diabetic can get a fracture without any injury. Hence, if there is swelling or doubt of presence of pus, an X-ray is recommended.

### CT Scan/ MRI



*CT Scan of foot*

There is a misconception among people that CT Scan and MRI report are just for the brain. But, it is useful for the whole body as well as the legs. CT Scan gives a detailed information of the bones and joints. MRI gives a report on ligaments,



atrophy in bones, pus formation, and nerves. Doctors advise getting this report when an X-ray is not sufficient to find out the ailment in the foot.

We can see infection, muscles, joints and bones in MRI ■



## FOOT COMPLAINTS IN DIABETES

It might be possible that the patient may not have any foot complaint at the time of diagnosis of diabetes or even till 4 or more years after that. After some time, the patient complains of tingling, burning sensation in the feet, cotton soft feeling or numbness.

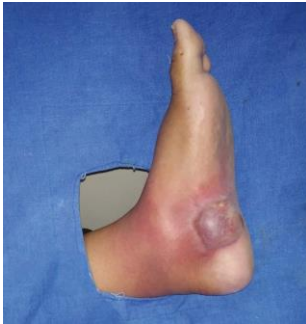
Some patients complain that they do not even realize when chappals or slippers come out of their feet. Many people come to the doctor with fungus between toes, stinking pus, or unknown blisters. There are also complaints about dry skin, loss of perspiration and heel cracks.



*Fungal infection between toes*



*Fissures/cracks*



*Blisters*



*Shoe bite*

Some patients complain about pain in the calf while walking, due to which they must stop walking for a while. Only then they can continue walking again. It happens due to less blood circulation in the leg. There are patients who visit the doctor with gangrene - blackened skin either of toes or feet.



*Black skin (gangrene)*



*Less blood supply and beginning of gangrene*



*Rat-bite injury*



*Burns due to hot water*

A few patients come with painless injury whose occurrence is unknown to them, like stinging of a thorn, wounds from the shoe-bite, burn from hot water but scalding sensation not realised and more. It might also happen that there could be a rat-bite at night and blood seeps in the bedsheet but the patient is not conscious of this happening at all. Same is the case with patients with ant bites. There are also complaints of losing balance while walking and fear of falling down.

There are patients who suffer from fever and cold like malaria and get it treated but are not aware of the unseen pus formation in the foot as a cause for fever. Sometimes, they visit the doctor in a critical condition when the toe and calf become red, there is breathing problem, low B.P., non-functional kidney, swollen leg.



*Spread of infection*



*Swelling of foot*



*In-growing toenail*



*Larvae of flies*



*Filariasis*

Like this, patients visit the doctor with complaints such as injury and pus, swollen leg, numb skin, problem in walking, gangrene and many more. ■

## FOOT INJURIES

Common people understand that it is only external factors that can cause an injury but a large proportion of diabetic patients are injured from within by their own bones. These patients get wounded and have wounds on their skin due to reasons such as reduction of fat in the sole of foot, the bones and joints getting deformed, dislocation of little bones from the joints, breaking of bones without any reason and many more.

Patients do not realize that this is not an injury caused by external factors. In majority of the diabetic patients, it is inner injury and due to neural problems, they are not even aware of the pain.



*Injury due to shoe bite*

Burning is one type of external injury. During bonfires in winters, patients do not realize that they have burned themselves due to neural problem. In summers, while standing or walking on a hot surface, blisters are caused.

Even falling of hot water, unknowingly, leads to burns.

Similarly, extreme cold can burn the skin like heat does. People living on snow-clad mountains may possibly get gangrene in toes due to walking in the snow.



*Gangrene due to walking in snow*



*Burns due to bonfire*



*Burns due to walking on hot surfaces*

Injuries from sharp objects are considered to be part of external injuries that everyone is aware of.



*Iron objects pierced in the sole of the foot through footwear*

Shoe bites are also externally caused injury. When the method of cutting nails is not correct, it can lead to injury.

Stiffening of joints and muscles causes the feet to lose its softness and due to this, there can be an injury while walking, inflammation, and sometimes formation of pus.



*Injury by one's own nail*

Sometimes, people massage with oil and pain-relief local applications for leg pain and swelling but it can cause serious consequences. The massage can lead to skin damage, peeling of the skin and spreading of pus in the whole leg. Patients of physiotherapy should also be careful that they do not burn themselves while taking wax therapy and light heating.





*Injury due to massage*

Patients can also get burned due to their leg touching the heated parts of scooter or other vehicles. Some patients get burned from the silencer of the scooter. In the same way, they might get burned due to sitting near the heated engines of bus, truck, or car.



*Injury by hot silencer of a vehicle*

Rat-bite in the bed or ant-bite are also commonly seen injuries.



*Injury by rat-bite*



*Injury due to mole rat-bite*



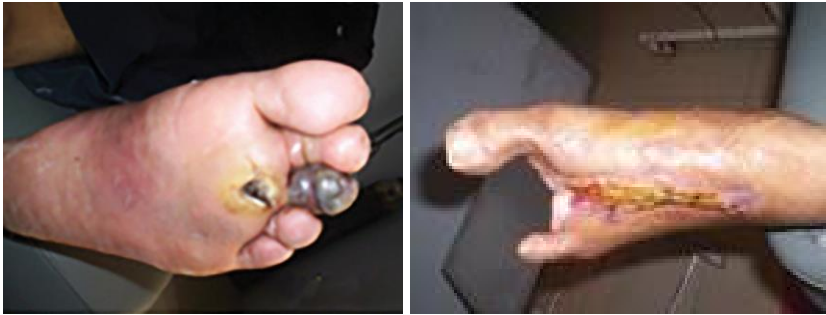
*Injury by ant-bite*



*Wearing rings is dangerous in diabetes*

Rings worn in the toes can hurt if the fingers/toes are swollen

Pilgrims invite injuries when they walk bare feet. Prayers done by standing on the shore of rivers can lead to leg amputation as there are sharp thorns, pebbles and many such things.



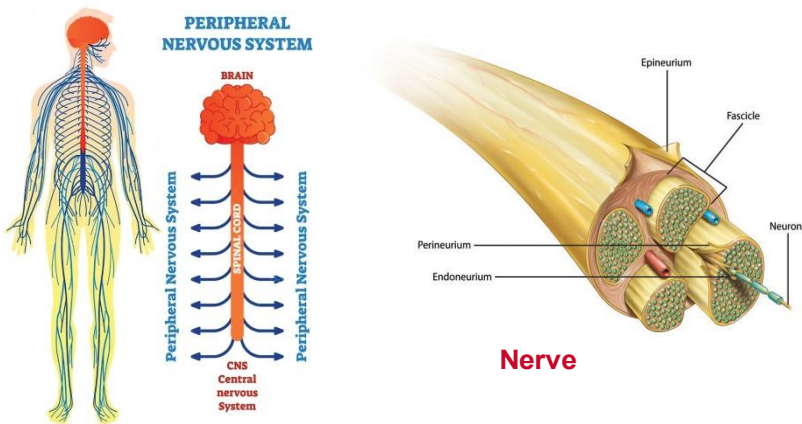
*Injury during pilgrimage*

Walking excessively can also lead to foot injury. If a diabetic patient, normally walking 2-4 kilometres with a footwear, walks 8-10 kilometres, even that might lead to shoe bite injury. ■

# DIABETIC NEUROPATHY

Diabetes is a disease that gradually damages various organs of the body. All the organs of the body consist of fine blood vessels. The damage of these blood vessels leads to the damage of the organs. Diabetic neuropathy is a condition of nerve damage which can also be caused due to the damage of blood vessels. Most people are generally aware about the injuries of blood vessels, damage to the brain nerves, kidney problems and the damage of the eye retina, but the severity of diabetic neuropathy is still unknown to many.

## Nerve Structure



*Cross section of nerve*

## Nerve fibres from brain to the limbs passing through spinal cord

A nerve consists of fine string-like nerve fibres and blood vessels. The nerves originate from the brain and connect to every organ in the body, including the muscles and parts of skin. The nerves conduct impulses from the brain to different parts of the body like the heart, blood vessels, stomach and intestine. From the very onset of disease, the excess amount of blood sugar starts damaging the outer layer of the nerves. Electric cables consist of a copper wire covered with a rubber-like substance. If the copper wire is naked, electricity passes through it causing an electric shock. Similarly, in diabetic conditions, when the outer layer of the nerve is damaged, it causes disturbances in the impulses transmitted from the brain to other parts of the body and vice versa. Hence, multiplicity of symptoms is observed in various diabetic patients.

Patients suffering from diabetes for more than ten years already have diabetic neuropathy to a lesser or greater extent. As the number of years increases, the damage increases. Along with the nerves, diabetes also causes damage to the fine blood vessels that provide nutrition to the nerves, making the condition worse. Apart from excess blood sugar, factors like blood cholesterol and reduced insulin being produced in the pancreas also contribute to the condition of neuropathy. The taller the height of a person, the more is the effect of neuropathy on his hands and feet. All of these factors are associated to diabetes.



Apart from these, factors like smoking, tobacco, alcohol abuse and genetic factors also affect neuropathy.

## Symptoms

Patients suffering from diabetic neuropathy have reduced ability to feel pain or temperature changes. Many patients experience numbness, padded feet, tingling or prickling sensation and sometimes also a burning sensation. Many patients suffer from hypersensitivity of skin and their skin has increased sensitivity to touch. Due to the effect of nerves on the muscles, conditions of muscle weakness, difficulties in walking, loss of coordination or balance while walking and deformity of toes/ fingers are observed.



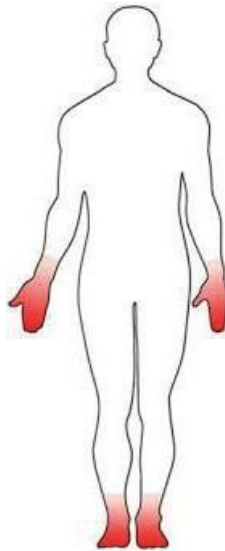
*Toe deformity due to wearing chappals and/or slippers*

*Deformed feet*

Diabetic neuropathy affects the heart, blood vessels, stomach and intestine. The nerve damage also leads to weakness in

stomach and intestine, digestion problems, slow emptying of intestines after eating, sharp drop in blood pressure after sitting or standing that may cause dizziness, urinary tract infections and problems of urinary retention and incontinence. It also leads to a decreased sexual response in both men and women, sometimes impotence, causing mental instability.

These nerves also control the sweating in hands and feet, which is why diabetic patients suffer from dry skin, heel cracks, cuts and wounds in feet.



Nerves of the parts of hand and feet get damaged (glove and sock pattern)

Diabetic neuropathy begins from the fingertips, gradually developing up to the wrists and also above the ankle. This condition is generally observed in equal proportions on both sides. The burning, tingling sensation and pain in the skin



getting insensitive sometimes increases to an extent that it starts interfering the sleep of the patient.

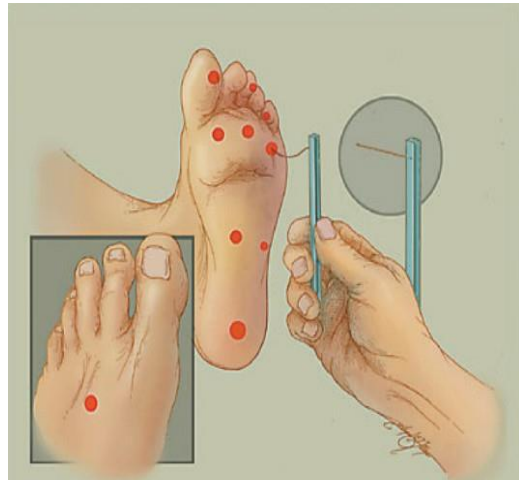
## Methods of Diagnosing Diabetic Neuropathy



*Biothesiometer*



*Tuning Fork*



*Examination with monofilament*

Generally, it is diagnosed by touching the patient's skin by hand and brushing a tool over the areas of the skin to test the patient's sensitivity to touch. It can be checked by pricking a small needle on the skin to check the sensitivity to pain. It can also be checked using a special nylon wire (monofilament) and

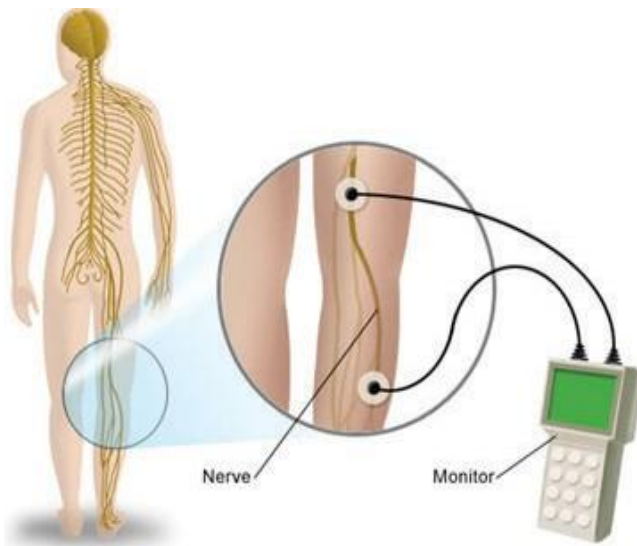


a special tuning fork. The monofilament is used to check the sensitivity to touch and the tuning fork is used to check how the nerves respond to vibration. This tuning fork is also used for the diagnosis of deaf patients.

There are also special equipment to check the sensitivity to changes of temperature, in which one end of it is cooled down and the other side is hot, and it is touched to various parts of the skin to check the response of nerves to the changing temperature.

Similarly, special electric equipment like the sensitometer can be used to check the response to vibrations on the feet.

Equipment to measure how quickly the nerves in the arms and legs conduct the electric signals to the brain are also available.



*Equipment to measure nerve conduction velocity*



## Treatment

There is no absolute cure for diabetic neuropathy. Patients frequently complain to doctors about numbness in feet, heaviness in the feet, burning sensations and pain. Consistently keeping the blood sugar within the normal range is the only key to prevent neuropathy. However, it cannot entirely heal neuropathy but can only delay its development.

The damage once caused to the nerves cannot be reversed which is why it is especially important to get the correct treatment for diabetes at the earliest stage to prevent neuropathy and delay it for more years. Finding a proper prevention for the feet before the problems arise delays the occurrence of the conditions. It is called 'prevention is better than cure':

There are medications only for diabetes-related nerve pain, which should be taken as prescribed by the doctor. Sometimes the patients are also prescribed vitamin injections which do not make much of a difference. The insulin injections work comparatively better. But if diabetes is kept under control right after its diagnosis, the conditions of diabetic neuropathy can be delayed to a considerable time.

Controlling the level of blood sugar is the only treatment. But then why does dysfunction still exist despite controlled blood sugar? This question is irrelevant because the nerve damage once begun cannot be cured in any way.

There are attempts to cure neuropathy by electric machines

on many people, while some also opt for surgeries to heal the condition. If the diabetic patient is under alcohol consumption, it should be stopped immediately as it only worsens the nerve damage. Many patients also complain of excessive pain, burning sensations and numbness in feet, for whom medicines to reduce the pain are available, but not the entire problem. Diabetic neuropathy gradually leads to loss of sensation which automatically reduces the pain in the patient causing the feet to feel no sensations at all.

There are also a few ointments available that can provide temporary relief to the patient from the pain. Devices like nerve stimulators are also available to control the pain.



*Nerve stimulator machine*

### **Foot Care for Patients of Diabetic Neuropathy**

The patients who have absolutely lost their sensation find it difficult to protect themselves from hot/cold or sharp objects. Due to the loss of sensation in their skin, they are unable to feel any sensations of touch or temperature. If a person not

suffering from diabetes comes across any thorn, nail, or stone, he manages to protect himself even while walking carelessly, but that is not the case with diabetic patients. Diabetic patients, when they visit temples or mosques in summers, even if they burn their feet while walking on hot surface, they do not realize it. Similarly, when the diabetic patients are sitting across a fireplace in winter, they do not realize even when they burn their feet. On the other hand, a normal person would immediately change the place on feeling hot. Hence, it becomes very important for diabetic patients to always wear clean, dry socks and cushioned shoes to protect themselves. ■



## FOOT CORN AND ITS CARE

This is a very common problem. Foot corns are areas of thick, tough skin that develop on the feet. But in medical science, there are various causes for such hardened skin to occur. Normal foot corns are even smaller than a centimeter. But such hard skin may be present in a larger area as well, which may or may not be called foot corn. In many cases, foot corn is also caused by hereditary factors. In one family many members are found to be having corns. But the infective lesions caused by viruses are also sometimes misunderstood for foot corn, they are actually warts. Foot corn is not infective but warts are.

A corn is a kind of thick skin with a hard centre in the foot or other parts of the body formed because of bone pressure against the skin.

Foot corns may occur in both diabetic patients and non-diabetic people. However, diabetic patients sometimes suffer from severe foot corns in comparison to the latter.

It is easier to prevent the growth of foot corns than treat them. When the foot corns are dry, rubbing off the dead skin with gentle pressure can prevent them from developing further.

Sometimes, pressure on the old foot corns may lead to damage of the tiny blood vessels around the infected area which causes

bleeding. This might be painful and also lead to formation of pus in the infected area. It starts turning black or red in color. At times, an injury in the sole of the foot might also cause viral warts which are difficult to treat. This may also be called Verruca Plantaris.

### **Who can have Corn?**

- People suffering from foot deformities are affected by foot corns.
- If there is bone pressure against the skin in any part of the foot
- Walking bare-feet in farms or being injured by thorns/ stones
- By keeping feet in dirty water for a long time in monsoon
- Ill-fitted shoes
- Sitting with folded legs
- As the age increases, the fat pad in the foot reduces causing pressure on it, leading to foot corn

### **Corns caused in hands**

- Excessively playing musical instruments like guitar, violin or sitar.
- Writing a lot
- Lifting heavy weight with fingers or palm
- Thickening of skin of hands & legs due to chemicals like Arsenic
- Frequent pressure applied on certain part of the body for professionals like barber, tailor, etc.

## Diagnosis

- Foot corn can be diagnosed by patients themselves
- A doctor can be consulted and it can be diagnosed by a biopsy report
- Sometimes the patients think the hardened skin as a foot corn but it turns out to be an infected viral wart. In such circumstances, it needs to be diagnosed by a doctor.

## Difference between Corns And Warts

CORNS	WARTS
They are pale yellow in color	They are white in color
Can occur in both hands and feet	Can occur in hands, feet or any other part of the body
Generally larger in size in any shape	Generally smaller in size in round shape
Caused by pressure on any part of skin	Caused by virus
Can be painful even when pressure is not applied	It is painful only when pressed



*Thick skin or callosity*



*Corns*



*Warts*

## **Treatment**

- Soak feet for 10-20 minutes in warm water each day and rub out dead skin using a pumice stone
- Wear comfortable shoes to avoid friction: loose footwear cause friction and too tight footwear cause bone pressure
- A doctor can remove the dead skin around it using a scalpel



- If the dead skin is not removed, it causes pus in the infected area



*Modification in insole*

- Never try to get the foot corn removed completely as it heals over a very long period of time
- You can buy specialized footwear to avoid the foot corns from recurring
- If the foot corn gets infected, contact a doctor and take antibiotics. ■

## DIABETES & SWELLING OF FEET AND LEGS

Swollen legs in diabetic patients are frequently observed. Some patients suffer from the swelling in only one leg while others in both. However, the reasons in both the cases are different.

Due to local causes in legs, the varying reasons for the swelling can be pus, fracture, legs hanging for a longer time, problems in blood vessels, filariasis, etc.

Whereas, reduced heart functioning, dysfunctional kidney, protein deficiency, thyroid problems, pregnancy, etc. can also be causes for bilateral leg swelling.

Elderly patients, those patients who sit with their legs hanging for a long time and those with knee and ankle ailments generally experience swelling in their legs due to lack of movement. Those suffering from varicose veins also experience such a condition.



*swollen feet and legs*

Many a time, medicines prescribed to control diabetes can also cause swelling in legs. Similarly, medicines prescribed to control blood pressure can also lead to swelling in legs to a lesser or greater extent.

Swelling in only one leg demands more diagnosis. Pus and germs can cause redness in the legs and swelling as well.



*Swelling due to filariasis*

Many patients also experience sudden swelling in only one leg which does not get cured even after several medications. When there are no complaints of a sprain or injury in the leg, both the doctor and patient consider pus or germs to be the reason for the swelling and begin the treatment, but many patients experience bone dislocation without any reason for which an X-Ray or CT Scan needs to be conducted to detect the reason.

People who sit at one place for a longer duration or those who travel through airplane for long, sometimes experience swelling in one leg or both legs. This usually happens due to

blood clots but can sometimes lead to serious ailments. Thus, people doing long journeys should keep exercising their feet or should walk a little in the plane after certain time interval.

Patients who have undergone joint replacement surgeries like hip joint or knee joint, or have had a surgery to heal bone fractures using screws or plates to hold the bone in place also sometimes experience swelling in the operated leg. Similarly, patients who have got a part of their foot or finger amputated due to pus also tend to experience swollen leg for some time.

There can be many reasons for swelling in both the legs of diabetic patients. Due to nerve problem, the closed path between the artery & the vein gets opened and this results into swollen leg. When the ankle and foot muscles grow weaker and the joints get stiff, they make the exercise of foot and knee difficult. This causes improper blood circulation resulting into swollen leg.

The medical reasons responsible for swelling in both legs can be heart failure, kidney diseases, thyroid disease, and protein deficiency. Sometimes, due to the germs of filariasis, along with cold and fever, swelling in one leg is also observed, which generally lasts longer.

## **Treatment**

A thorough investigation should be conducted to identify the reasons for swollen legs. If there is no other disease except for swelling in legs, one should sit on the bed by keeping the leg straight or by supporting it with cushions and the swelling

can be reduced.

However, swelling due to medical reasons can only be cured with proper treatment under a doctor's guidance. If these medical reasons are heart failure or dysfunctional thyroid gland, then a proper treatment should be conducted or in case of protein deficiency, it can be cured through intake of supplementary protein.

Sometimes, diabetes experts/ physicians tend to make changes in the dosage of diabetes or blood pressure medications, which also help cure the swelling. One should avoid taking medicines that lead to excess urine formation without consulting a doctor. Due to dysfunctional thyroid gland, patients tend to experience swelling on the face as well as legs, which can be treated by the intake of proper medication. However, it is very important to consult a doctor if the swelling is caused due to pus or blood clots or varicose veins.

Swelling caused due to an ailment called Charcot foot does not cure. In a condition like this, swelling in one leg is generally observed and doctors generally advise to keep it covered in a plaster cast for its treatment. It is also advised to avoid walking with that leg for minimum 2 months to sometimes up to 8-10 months. If movement in that leg increases, there may be blisters on it and this might lead to amputation of that leg.

Swollen legs can also be treated using machines but it becomes very important to be aware of the proper treatment in such a case.

The major reason for swelling in legs is the accumulation of water under the skin. This accumulated water rises in the body through the lymphatic system, mixes with the venous blood and makes way out of the body through the urine. In filariasis, this lymphatic system gets infected leading to block in the lymphatic nodes. This gradually leads to increased swelling in the legs, the treatment of which is generally very difficult. Filariasis is almost a permanent problem. Certain surgeries to treat this kind of a swelling are available but are very costly with low success rates.

In the same way, surgeries are one reason why sometimes the lymphatic glands stop functioning.

Surgeries conducted on the root of thighs, in the abdominal cavity or for cancer cause these lymphatic nodes to stop functioning leading to swelling in legs. One example for this can be the swelling in arms that women suffer from after they have undergone a breast cancer surgery. Similarly, when radiation therapy is done on root of thighs to treat cancer, it leads to swelling in legs. ■



## PIERCING OF NAILS IN SKIN OF THE TOE

Nails are hard substances. If we trim the corners of our nails deep and the skin is on the nail, when we walk, due to the weight of the body, the nails are pressed under the skin and the skin comes on top of it. Due to this, the corners of the nails pierce the skin which results in to swelling in the skin and sometimes also infection. Such a condition is observed mostly in the great toe of feet and can also happen to patients who do not suffer from diabetes. However, this is observed more in women, as they trim their nails round and deep to make them look beautiful.

Besides trimming the nails deep, it can also happen to people who wear shoes that are narrow in the front. Generally, this cannot be called a disease but rather a self-created problem.

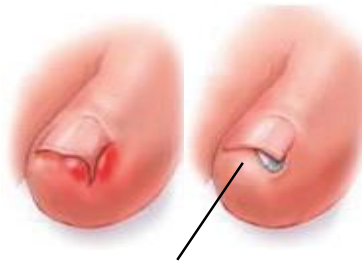
If the nails are not trimmed deep, this problem will barely occur. Sometimes, if the corner of the nail breaks accidentally, it can also give rise to such a condition.

It is very important that this does not happen to diabetic patients because even the smallest problem can turn into serious disease for them, which might lead to situations like having to amputate the entire toe itself.

There are two ways in which the nails can pierce the skin: 1) the nail can pierce while growing, or 2) the nail bends into a C shape on the front of both sides.



*CshapeNail/*



*piercing in front*







*In -growing toenail and its treatment*

## Operating the Nail

- If the nail grows and finds its way out of the skin, this condition can be cured. Sometimes, it can be treated by removing the skin or the nail.
- But it is difficult to treat a nail that has bent into a C shape on both sides. In such a condition, even if the nail is operated and removed, a similar condition will occur after 2-3 months once a new nail grows.

## Solutions

- Always let the nails stay out of the skin.
- Do not trim the nails of the toes deep.
- Do not wear narrow shoes. ■

## INFECTION OF BONES [OSTEOMYELITIS]

Almost 15% of diabetic patients suffer from ulcers in their feet and 15% of these suffer from infection of bones.

Generally, the infection of bones begins from the skin side of the foot, where it begins with pus in the skin which gradually spreads to the bones. Sometimes the bones can get infected directly from the blood as well. If the wounds are too deep, the bones of that wound are more likely to get infected. If the bones are clearly visible from the wound, it is certainly a sign of infection in the bone. If the leg is affected by gangrene (especially by wet gangrene), the bones have absolute chances of infection. Sometimes, instead of infection in bones, formation of pus is observed in the joints, which eventually leads to infection of bones around the joints.



*Osteomyelitis in left toe bone*

In the condition of Charcot foot, if the bones get infected, it is difficult to heal.

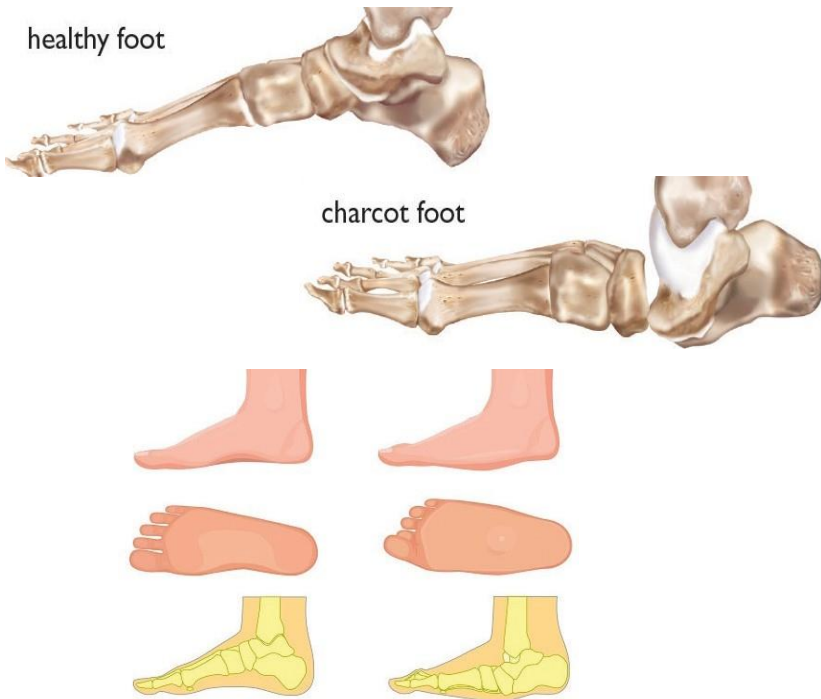
The infection of bones can be diagnosed by only looking at the wound, an X-Ray of the foot, sometimes also by a CT SCAN or MRI. It may so happen that despite there being infection in the bones, it is not visible in the X-Ray in the beginning and it is diagnosed a month later.

A ridiculously small piece of the bone can be tested in the laboratory to find out the type of organism and antibiotics can be prescribed to treat the infection. Sometimes the bone has to be removed for treatment. Medicines can be helpful in treating the infection but it depends on the position where the infection is located; in case of more infection, fingers/toes/ some part of the foot sometimes needs to be amputated. ■



Charcot foot is a worse and difficult problem for diabetic patients. Patients having neuropathy and those with long term diabetes are more likely to have this problem. Apart from diabetics, patients with leprosy and spine problems may also get this disease.

### What happens in Charcot foot?



Diabetic patients have weakening of foot-bones. Foot joints may get loose and foot gets deformed. There may be swelling in the foot and bones may start breaking without any injury.

In such patients, the cells responsible for the formation of bones become less active and those responsible for its destruction become more active. The shape of the foot starts changing. The bones start flattening so much that the mid-part of the foot (medial arch), which usually does not come in contact with the ground, starts touching the surface of the ground. Due to increased weight on the middle of the sole, its skin becomes thick like that in foot corn before it breaks and a wound is formed.

The foot can possibly be saved if this disease is diagnosed in the early stages. But, if the diagnosis is delayed, wounds are formed, and even after long treatment the foot has to be amputated.



*X-ray showing deformed bones in Charcot foot*





*Wound in the centre of the foot and inward projection of the bone*



*Charcot foot with wound*



*Different types of Charcot feet*



*Charcot foot without wound*

### **How to diagnose in early stages?**

Swelling in foot begins after a small jerk or a minor accident. The swollen foot is warmer than the other foot.

It usually does not cause pain. At times, this occurs even without complaint of any injury.

If the foot pulse is examined, there seems to be rapid blood flow. Initially, the shape of the foot flattens. Gradually, the bone from the inner part of the sole of the foot bulges out, and in absence of proper treatment the middle of the foot begins to swell.

The problem in bones and joints is limited to the forefoot and midfoot, but sometimes, joints and bones of the ankle are damaged, and the foot gets too distorted to walk.

When swelling is seen in one foot, most of the doctors and patients believe it to have occurred due to infection. A significant amount of time is spent on the treatment of infection.

Meanwhile, the bones and joints of the foot are further damaged, and consequently, after a few years the foot has

to be amputated. This disease is seen rarely in both the feet simultaneously.

The patients of diabetes have swelling in both the legs and feet due to low haemoglobin, blood pressure and its medicines, heart disease, liver disease and protein deficiency. Thus, swelling in both the legs and feet should be considered more a medical disease rather than foot disease in diabetes.

Swelling in one foot demands more diagnosis, and as we have seen, in such a case, there can be possibility of Charcot foot, pus formation, blood clot, elephantiasis/filariasis or some kind of gout.

### **Types of Charcot foot**

There are two stages of Charcot foot.

1. Acute Charcot
2. Chronic Charcot

Acute Charcot involves sudden swelling in one foot and damage in bones. This is a change observed in the foot in a shorter period of time. If the swelling is diagnosed at an early stage, there is no other treatment required other than complete rest with a plaster in the foot.

Chronic Charcot means after the swelling in foot, the bones get deformed and then remain in such position. Such a foot loses its shape and gets affected with corn and wounds at different places. It remains like this for a long time.



Early diagnosis of Charcot foot is more important than all other factors, as the resulting problems can be prevented by early treatment. The foremost treatment is neither to stand on the diseased foot nor to walk with it, otherwise bones may get deformed and crumbled with internal bleeding.



*Treatment of Charcot foot by plaster and specialized footwear*

## **Diagnosis**

A blood report shows the causes of foot inflammation and the presence of germs. In case of pus in the foot, the blood report will be different. There is no significant change in blood report in Charcot foot. Reports measuring bone density, and calcium and vitamin D level in the blood also need to be done in case of Charcot foot.

X-ray: An X-ray should be done for both the feet (swollen and normal) in order to know the beginning of change in bones by comparing them. Sometimes, in early stages the X-ray of the foot only in standing position can lead to the diagnosis because of weight of the body.

C.T scan / MRI: When it is difficult to decide from an X-ray whether the problem is due to Charcot foot or infection of bones, advanced reports like C.T. Scan or MRI can help.

### **Treatment**

Sometimes, the bones are strengthened and the leg can be saved only if it is kept in plaster for 3-6 months.

If Charcot foot is not diagnosed in early stage and bones of the foot get distorted, there is a wound or corn, there remains no option other than the use of special footwear to protect the feet. The foot is to be protected lifetime by covering it.

### **Medication**

Medicines for strengthening bones and for bone to unite are available in form of pills and injections given by doctor as per the need. These medicines have to be taken for a long time. Many patients are given medicines of vitamin-D also.

### **Treatment by operation**

When the foot becomes deformed and weakened from the ankle, operation is to be performed and a screw and plate are to be placed in the bone. ■

## VARICOSE VEINS

Normally, there is an upward flow of blood in the leg, but in the varicose vein, the blood flow is in the opposite direction. This downward flow of blood causes swelling of veins.



*In normal person, the valve opens upward and blood flows upward in veins*

*In varicose vein patient, direction of flow is reversed*



*Blood flow in normal person and varicose vein patient*

Varicose vein can be found in patients with or without diabetes. It can be found in barbers, vendors, teachers, long-run drivers, people who got knee or hip joints-replacement surgery, people who stand or sit with legs hanging for a long time, etc.

It may also occur during pregnancy. This disease damages the valves of veins in the leg, and due to that, the impure blood

from the leg does not flow towards the heart, and instead, gets filled in the veins of the leg itself. This causes the swollen veins to be visible in some patients, blackening in part of the skin above the ankle joint, the inner and outer part of the ankle shows signs of chronic ulcers, and partial swelling in the leg frequently. Sometimes, it might happen that the blood gets clotted in the veins and that causes damage to the valves. This disease can happen in either a single leg or both. There is hardening, blackening, and thinning of the skin around the ankle, and the area around the knee and calf is swollen in the patient suffering from this disease and the area around ankle becomes thin giving inverted bottle appearance.



*Varicose veins without wound*



*Varicose veins  
with wound*

The presence of ulcers is not necessarily found. The patients suffering from stiffness in knee and restricted movements of the foot are likely to acquire this disease. It is seen, sometimes, that blood suddenly showers out from some part of the foot and leg from an ulcer.

## Diagnosis

The diagnosis is often possible by just looking at the leg. Color Doppler Sonography test can also be conducted on the blood vessels of the leg to verify the diagnosis.

## Treatment

The necessary part for the success of the treatment is the change of the patient's occupation. The treatment includes sitting with leg elevated, avoiding standing for too long, to keep exercising the ankles, and not sitting with legs hanging.

There are certain types of medicines available to treat varicose veins, but they do not contribute much.

Laser operations can be performed as per doctor's advice but they may have to be performed time and again. Therefore, change in occupation is the first and foremost treatment. Apart from operation, special dressings and special stockings are useful in controlling the disease. Elasto crepe dressing is also part of the treatment but it should be used only after taking the doctor's guidance.



*Result obtained with the help of specialized  
four-layer compression bandage*



*Stockings for  
compression  
therapy*



*Specialized compression  
bandage*



*Elastocrepe bandage  
to reduce swelling*



*Lymphapress  
machine and treatment of  
swollen leg*

Lymphapress is a special kind of machine consisting of a particular stocking/sleeve which helps in draining the blood from the toes to the thigh by creating air pressure that presses the veins of the leg. This machine is used for reducing swelling in the leg as well as for varicose veins.

If blood starts to ooze out of leg or ulcer suddenly, the patient should immediately lie down and lift the leg two feet high off the ground and then tie a dressing tightly around it. It is possible that even after doing this, the blood does not stop coming out. ■

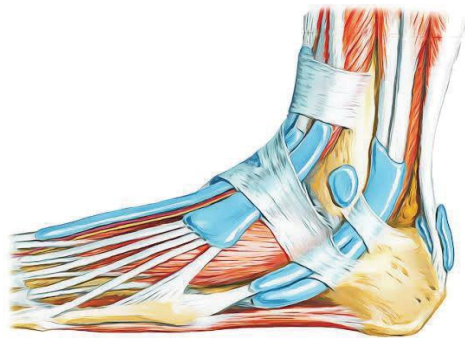
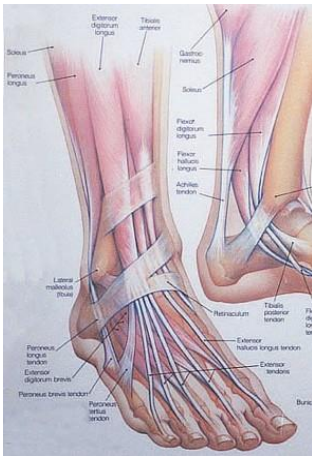
## INFECTION IN LEG/FOOT AND ITS SPREAD

When something injures the leg and the skin breaks, it causes germs/bacteria to enter the leg. If a sharp object like thorn or nail pierces, it takes the bacteria deep into the foot and sometimes the thorn that had pierced in the bottom of the feet will move in between the finger and spread the pus upwards. Thus, compared to simple injury, sometimes the injury caused by sharp objects takes the pus deeper.



*Different types of infections*

There are several muscles starting from fingers/toes to the knee. All these muscles do the work of the movement of fingers/toes, foot and leg. There are many other small muscles that are working for the movement of leg. These rope like muscles are stuck to different places in the foot in the form of strings/threads, so when pus occurs around these muscles, then the rope moves back and forth and along with it the pus also spreads further from toes to the middle part of the foot and after that it moves towards ankle, to lower leg and also spreads till the knee.



*Spread of infection through the tendon sheath*



*Infection at the back of ankle and leg*



Similarly, if the movement of the ankle is not restricted, pus that has started from the back of ankle, would reach the knee passing through lower leg and calf.

Thus, to prevent the spread of pus and for performing less operation, the movement of leg should be stopped and if needed, foot/leg can be plastered for some time. During operation, especially, the way of muscle tissue is made open and its spread is found and cleaned. The wounds are not to be closed when there is pus.



*Blisters*



*Application of plaster to heal wound around joint*

Sometimes, infection spreads faster under the skin. There are blisters on the skin. Pus which starts from some parts of foot sometimes, in hours or in days spreads up to knee or thigh. This disease is known as Necrotising Fasciitis.

It is a critical disease and sometimes, it proves to be fatal. Such patients are sometimes, shifted to ICU due to the problem such as shortness of breath, inability in urination and kidney failure.



*Necrotising fasciitis*

## **Treatment**

Patient suffering from these diseases should be first admitted to hospital and intra-venous antibiotics should be given. If required, by performing operation that part can be cleaned. For saving lives of some patients, even leg has to be amputated.

## Madura Foot



It is a disease caused by fungus. Like bacteria, fungi can also cause problems. This disease is more seen in people walking barefooted on field, labourers and farmers. It doesn't spread fast. For years, people can walk on their feet. The disease does not heal and even leg may not be amputated and for many years, mustard like granules of fungi emerge from tiny holes. ■



## **PROBLEM IN BLOOD VESSELS (GANGRENE)**

Gangrene is a condition in which the decrease of blood supply causes the body tissues in certain parts to die.

Both diabetic and non-diabetic patients might suffer from gangrene. However, if the patient is suffering from diabetes, they are more likely to be affected by it. Most of the times, gangrene affects the thumb or fingers/toes, hands and legs. In certain cases, it is also found in other parts of the body.

From the heart, pure blood flows through the entire body via small and large blood vessels. The walls of these blood vessels are soft as rubber and elastic in nature. The blood vessels that carry pure blood from the heart to various parts of the body are called arteries and those carrying impure blood from all parts of the body are called veins. The blood flows through the veins towards the heart's right ventricle and further towards the lungs where the purification of blood takes place. The purified blood flows from the lungs to the left ventricle of the heart and further to the entire body, making adequate nutrition available.



### *The process of narrowing of blood vessels*

These blood vessels begin to wear off as soon as they are formed. Fat is deposited in the inner layer of the blood vessels and their inner wall becomes rough and as the fat gets accumulated, it begins to obstruct the flow of blood, because of which, the blood vessels become narrow.

Blood vessels are formed of three layers. There is deposition of fat in the inner layer which creates blockage. The thickening of middle layer also adds to the obstruction. As they move away from the heart, they become narrower and further get divided into small capillaries.

In diabetic patients, there are multiple reasons responsible for causing damage to these blood vessels. The excess amount of sugar in the blood damages the protein elements of the vessel causing it to become more fragile. Besides that, the accumulation of fat and blood clots on the walls of the vessels is also observed to be the cause of reduction in flow of blood. This is known as PVD (Peripheral Vascular Disease).

Cigarettes, tobacco and alcohol addiction contribute further to the narrowing of the blood vessels and worsen the damage in the blood vessels of the heart and legs caused by diabetes.

Many people are heard saying that the arteries in their legs have dried but in factuality, there are two types of systems in the leg-one that carries the blood from the heart (arteries) and the second that carries sensations via nerves from skin to brain and brain to skin.



*Early stage of development of gangrene (Blue/pale foot)*



*Gangrene*

People find it difficult to differentiate between two of them. Feeling numb in the feet, burning sensations, softening of feet, the feeling of padding in the feet while walking etc. are experienced by the damage of the nerves of the brain.

Whereas, blackening of toes/fingers, pain in the legs while walking, burning sensations that can possibly interfere with the sleep at night and coldness of feet are symptoms of damage to the artery. Patients with a damaged artery can possibly lead to gangrene.

Patients having decreased circulation of blood in the legs feel relief only when they sleep with their legs hanging or when sitting. The pain or burning sensation increases if they sit with their legs elevated. Patients with decreased blood circulation in the legs tend to experience pain in their calf and stop after walking for 100, 200 or 500 feet and can walk again after the pain is relieved. This is a serious complaint and if the surgery to reopen the artery is not conducted on time, even the smallest injury can lead to gangrene.



*Infected and amputated left leg*



*Left foot partial amputation*

Patients whose nerves in the spinal cord are getting pressed also feel like their legs have become heavy when they walk too much and can walk again after the pain is relieved. Hence, necessary reports need to be done to identify whether the pain in the legs is due to the nerve or the artery.

However, the matter that demands careful attention is that patients having a blocked artery, when suffer from even the smallest blister or infection in foot, it can worsen to a greater extent which might even lead to the need for amputating the leg. Any patient who just got their foot operated and has black dead tissues in toes/foot indicates that the blood circulation in that area has reduced and that the leg is at risk. Even if they don't have to get their leg amputated, the healing itself becomes a difficult task.

## Types of Gangrene

### 1. Dry Gangrene





When the blood circulation in any part of the body reduces or stops completely, it leads to dry gangrene.

Blood plays the role of carrying oxygen in various parts of the body. All the cells and organs of the body require oxygen to remain alive. If any part of the body does not receive oxygen, it dies. That part turns green or purplish blue or completely black and the skin becomes dry.

This dead part turns black and gradually gets detached from the healthy tissue. This process is known as auto-amputation, which takes up to 8-10 months. It is possible to wait in dry gangrene. It does not demand an operation urgently.

## 2. Wet Gangrene



Diabetic patients have reduced blood flow in their legs which leads to immediate increase in the formation of pus in foot wounds. If the portion is not treated properly, it might later have to be amputated and can prove to be life-threatening at times. Signs like pus discharge, foul smell from the infection

part and increase spread of bacteria are observed in wet gangrene. It is not possible to wait in wet gangrene and it needs to be operated immediately.

### 3. Gas Gangrene



Certain bacteria produce toxins that release gas and harm muscles, soft tissue, and cells or organs. The skin turns brown or red in color with blisters. This type of gangrene occurs suddenly and spreads very

fast and can also be life-threatening. Patients who've met with a road or rail accident tend to suffer from this type of gangrene.

### 4. Internal Gangrene

This type of gangrene occurs when blood flow to the internal organs is stopped. It may cause fever and extreme pain. It affects organs like intestine, gallbladder or appendix.



*Gangrene of intestine*

## S. Fournier's Gangrene



*Gangrene of male genital organ*

### **Prevention of Gangrene and its Treatment**

Patients should give up their addictions. If the arteries are blocked, they should be operated and reopened as soon as possible to prevent gangrene. If it is not possible to reopen the arteries, medicines for blood thinning should be taken for a longer duration. If it is wet gangrene, it should be operated quickly and the infected or dead tissue should be removed with proper treatment to enable blood circulation. ■

## DIABETES AND SKIN DISEASES

Diabetes causes harm to any and every organ of the body and so, why wouldn't it to the skin (which is considered the largest organ of the body)?

Diabetes causes many skin diseases. Skin acts as a protective cover, preventing germs to enter the body. Skin not only regulates the body temperature but also, concentration of salts like sodium and potassium. It also maintains water level in the body. Skin also safeguards the body from ultraviolet rays.



Diabetes disturbs all of the above-mentioned functions of skin and therefore, in order to keep the skin smooth, various medicines and ointments should be applied. These include oily substances, ointments containing urea and ointments that protect the skin from sun's ultraviolet rays.

Patients of diabetes suffer from scratching and itching sensation more than anybody. This is mainly due to age, kidney malfunction and side effects of the medication. Mental stress too, is a cause for skin disease.

There are various skin diseases caused due to diabetes. The following are the commonly seen diseases:

### 1. Skin dryness/ drying of skin

Malfunctioning of nerves reduces the sweat secretion, causing the skin to dry. This results into cracks both in hands and feet and a sensation of itching in the entire body.



*Dry skin*

### 2. Boils: (Diabetic Bullae)

Boils due to accidental burns in diabetes patients is common, but 1% of the patients face this problem even without any particular reason. These boils carry water and may cause more boils. They don't cause any kind of pain and generally get cured automatically.



*Blister in diabetes*

### 3. Corns and warts



*Callosities and warts*

Many patients face the issue of thick skin in foot, known as corn. Callosity too, is thickening of skin but it is more severe than corn and affects many parts of the body. A similar disease to corn, caused by virus, is known as warts and it is infectious.

Corns and callosity can be cured through operation, while warts must be treated and burned with laser or electric machine.

#### **4. Skin darkening and skin thickening (Acanthosis Nigricans}**



*Black discolouration of skin*

Such type of skin is usually found in armpits, neck and elbows. Generally, this is observed in patients who have developed resistance power against insulin hormone.

To keep the skin smooth during treatment, patients should use ointments, salicylic acid and medicines containing urea, as per the doctor's advice.

## 5. Infectious diseases of the skin

Infection by fungus:



*Fungal infection in the skin  
between toes*



*Fungal infection in nail*

Fungal infection can be seen in the space between two toes, in nails, as well as parts of the body that sweat. Sometimes, severe infection is also seen in eyes and ears.

Bacterial infection:



*Carbuncle back*





*Foot infection*

Bacterial infection causes various kinds of boils (smaller in size) all over the body. These boils sometimes occur frequently. It also causes pus near the nails and armpits. Sometimes it causes a bigger boil on the back (known as carbuncle). And so often, a large portion of skin in foot gets damaged and the pus spreads. This is known as Necrotizing Fasciitis (NF).

Exterior parts of the ear may also get severely infected with pus.

Skin diseases that are like circular rings, are observed in the diabetes patients. Small boil like bumps are observed at different parts of the body. Sometimes thickening of the skin is observed too. The fat around the part where insulin is injected becomes hard and sometimes creates a dint too.

Sometimes the skin turns yellow even without the presence of jaundice.

## **6. Changes in nails**



*Thick nails*



*Irregular nails*



*Blood collection under the nails*





*Brittle nail*



*In growing nail*



*Long vertical streak  
in nail*

As we have seen earlier, fungal infection and pus are a common occurrence near the nails. Roots of the nail turning slightly reddish, thickening of nails, improper shape, blackening of nails due to blood clots under it, frequent falling out of nails, the corner of the nails damaging the skin, long vertical lines on the nails, brittleness of nails etc. These are a few of the problems related to nails that diabetes patient faces.

## **7. Skin cancer**

The pus is not the only major skin issue. There are various skin diseases the patients suffer from; one of which is cancer. Very few people suffer from foot's skin cancer.



*Cancer of skin*

## 8. Other skin diseases



*Dermapathy*



*Eruptive xanthomatosis*



*Granuloma annulaire*

There are many other skin diseases that patients suffer from during diabetes. Some of them are shown in the pictures below. ■



# IMPORTANCE OF DRESSING IN HEALING OF WOUND

Every common person is aware about applying antiseptic medicine to wounds. But dressing is a wide field having an availability of different kinds of dressings consisting of scientific medicines. Furthermore, the drugs used in bandaging have different working methods and their effect varies from time to time.

## 1. Antiseptic Dressings

Disinfectant medicine which is applied on any part of the body is known as an antiseptic medicine. It is available in the form of eyedrops, mouth fluid, powder and ointments. Antiseptic medicines are not for the purpose of consumption. They are used only by applying on surface, whereas antibiotic medicines can be consumed, injected through syringe and can also be applied on the skin.

The function of both types of medicines is to kill germs but antibiotics require the immunity produced by the body whereas antiseptic medicines kill germs on their own.

## 2. Absorbent Dressings

Commonly, cotton or a cloth piece is put for absorbing pus and

fluid. But, nowadays, different kinds of dressings are available which can absorb the fluid and retain within themselves. The bandage does not get spoiled from outside and provides enough moisture to the sore. The conventional types of dressings had to be changed regularly or on alternate days, but these new types of dressings can be kept for 5-7 days. The sponge used here is similar to that used in sofa and scooter seat.

There are many different types of dressings available for the absorption of pus and fluid.

For e.g. Foam dressing, Hydrocolloid dressing, Alginate dressing, wound dress dressing.



*Special types of dressings*



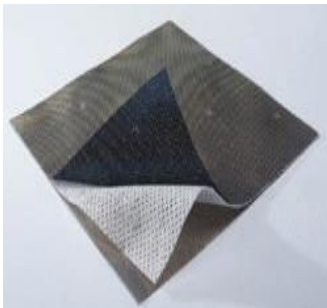
*Foam dressing*



*Hydrocolloid dressing*

*Antiseptic medicines are mixed with such absorbent dressing to prepare special types of dressings which, besides absorbing pus, can kill germs for 5-7 days. Example, Acticoat for removal of yellow pus.*

### **3. Dressings for the removal of yellow pus**



*Acticoat*

When doctors do dressing, they remove yellow pus lying on the wound by rubbing them with special types of instruments. But in some cases, patients feel immense pain and don't allow to clean the yellowish sore by rubbing until it becomes red.

For such patients, there are special medicines available which remove decayed tissue, yellowish or dead skin from the sore when applied. They melt the decaying tissues and when dressing is opened, such tissues come out in the form of pus, and the sore looks red and healing.

#### 4. Dressings for fast healing



*Collagen(protein)  
powder dressing*



*Collagen sheet*

Every sore doesn't require antiseptic medicine. There are various types of medicines available for wounds which are big so that they take less time to heal and the skin reappears quickly. Protein element is very useful for healing. Bandages having protein element are also available in the market. For e.g. Collagen dressing, is available in the form of powder, sheet or ointment.

There are special kinds of expensive ointments, in which certain protein elements produced from blood platelets are applied on the sore in the form of ointment that help bringing redness and new cells in the sore quickly. Such ointment is made in laboratory and is kept in a refrigerator lest it gets damaged.

The patient's blood is extracted from which white blood consisting of platelets is separated and then injected through a syringe to the sore and areas around it, making the healing process better.

## 5. Dressings for eliminating bad odour of sore



*Charcoal powder*

Sometimes, foot sores have extremely bad smell. For such foot sores, dressing is done by some kind of medicines which eliminate bad odor for time being. Metrogyl or Charcoal powder is an effective remedy but the main cause for bad odor is germs. Disinfectants also have to be used as well. Besides, if needed, dressing is done twice a day.

## 6. Dressings to be done when there are Maggots in wound

Sometimes, flies sit on a wound and from their eggs, worms are formed which are called Maggot. These worms are similar to those brewing in a gutter. In real sense, they



*Maggots (Fly larva)*

do the work of eating the dead tissue and pus of the wound. Generally, they don't eat healthy skin or tissue, but the worms of some other species of flies damage even the healthy part. To get rid of these worms, a medicine named Turpentine is useful.

It does the work of removing and killing the worms. Besides, a medicine named Hydrogen Peroxide also eradicates and kills

the worms born out of flies. These worms build tiny caves and it becomes difficult to find them. Sometimes, they are found in deep holes.

It surprises us that the worms we are talking of eliminating are used in foreign countries for healing of foot wound. The difference is that they use worms of a special type of fly in sterile condition. When placed on impure wound for 2-3 days, they remove all the impurity and make it healthy. These worms are not available in India. This type of therapy looks ugly but proves to be a boon for some patients. ■



## TREATMENT OF FOOT WOUNDS THROUGH OXYGEN

Any wound present in any part of the body requires oxygen along with nutrients to get healed. In diabetes, due to narrowing of blood vessels, less oxygen reaches the wound. Similarly, blood vessels of addicts of cigarette, tobacco and alcohol become narrow resulting in inability to gain sufficient amount of oxygen.

In some types of foot wounds, germs are of such type that they grow more in absence of oxygen and harm the body. In such wounds, treatment through oxygen is beneficial.

Types of treatment provided through oxygen:

1. Hyperbaric Oxygen Therapy
2. Simple Oxygen Therapy
3. Ozone Therapy

### 1. Hyperbaric Oxygen Therapy



*Hyper baric oxygen chamber*

In comparison to pressure of oxygen in atmosphere, when a patient is made to consume oxygen, with 2 to 3 times more the pressure

of oxygen in atmosphere through inhalation, the red blood cells and blood fluid gets saturated with oxygen. This blood containing excess oxygen, when reaches the portion containing wounds, it improves the process of healing. In minute capillaries/blood tubes where even the red particles cannot enter, oxygen reaches through blood fluid and helps in healing. This therapy can be taken daily for an hour for 15-20 days. In addition to wound healing, this therapy can be useful to prevent gangrene, to avoid amputation of leg in the beginning of gangrene, for the patients suffering from the effects of toxic carbon monoxide gas and for the patients who had any of their body organ mashed in a railway or road accident.

In this method, patients are given oxygen by seating in a special kind of glass chamber.

## 2. Simple Oxygen Therapy



*Local oxygen treatment device*

When a patient is serious, he is provided with oxygen by a tube inserted in nose. This is called simple oxygen. In this, the pressure of oxygen is equal to the pressure of oxygen in the atmosphere and from such oxygen; the blood cells and blood fluid do not get completely saturated.

A special kind of instrument is used in such a manner that oxygen directly reaches the wound.

There are several types of such machines. A small fist-like machine (natrox) which is adhered to the wound, takes oxygen from air and supplies to the wound. Moreover, the patient can continue his normal activities after the application of the machine.

In the second method, for wounds of hands and legs, a special set of transparent bags is available which is to be worn on hand or leg and it is tied in an air-tight manner and filled with oxygen through a special machine. Direct oxygen is given to the wounds, which helps in healing. This treatment can also be taken daily for 1 hour for 20-30 days, having no side effects.

### 3. Ozone Therapy



*Oxygen and ozone treatment  
through a bag*

Ozone therapy is also a type of oxygen therapy. Ozone is known as  $O_3$  whereas oxygen is known as  $O_2$ . Ozone is ephemeral. It gets converted into oxygen in a noticeably short period. However, as long as it lasts as ozone, it is more effective for healing a wound than oxygen.

There are many methods for giving ozone. Ozone gas can be given through a bag worn on the hand or leg. Besides, it can be given through nose, dissolved in glucose bottles or through the rectum. ■

## TREATMENT OF FOOT WOUNDS BY MACHINES

Different types of machines are used for quick recovery of foot wounds. A device generating electricity, a type of sonography machine producing non-audible sound waves, and a shock-therapy machine used for breaking the kidney stone into pieces are same machines used. Apart from that, there is a special type of sock/sleeve, available which can be inflated by electricity and it can compress and squeeze the leg from the foot to the thigh. It is helpful in the leg ulcers of varicose vein.



*Wound treatment with sonography machine*

Laser machine is also used for the treatment in the foot wounds.

These instruments are not commonly used in India, but the countries with sound economic condition use them for healing long term non healing wounds.



*Wound Treatment by Electric Machine*



*Machine to improve blood circulation and reduce swelling*



*Laser machine*



*Treatment of a wound by vacuum*

Foul smell can be removed by a machine which sucks pus (Vacuum Machine). Inside it, there are dressing materials which make the wound airy and it is connected to a machine through a tube. This machine constantly removes pus, fluid, and bad odor, and helps to heal the wound. ■

## TREATMENT OF FOOT BY OPERATION

For the patients of diabetes, the occurrence of pus and wounds, deformation of bones and long-time taken for healing of large wounds are some of the problems for which, different types of operations have to be performed as per the need.

In case of pus in the leg, operations have to be performed for treating it and saving the leg. In such cases, sometimes, the leg can be saved merely by making a cut. Sometimes, one or two or more fingers may have to be cut and at times, the whole leg has to be amputated. Stitches can be taken post-operation. If the skin is to be cut excessively for adequate removal of pus and dirty tissue, then the wound is kept open and allowed to heal by dressings without taking stitches.



*Operation by cleaning the foot under anaesthesia*



*Operation by cleaning dead tissue*



*1<sup>st</sup> toe amputation*

*2<sup>nd</sup> toe amputation*



*Amputation of three toes*



*Partial foot amputation*



*Amputation below knee*

Sometimes, the germs are so infectious that they quickly reach the lower leg, knee, or thigh. In such circumstances, effort is made to save the infected part by leaving it open. But, sometimes, depending on the strength of the germs, seriousness of the situations and age of the patient, the leg has to be amputated from below or above the knee. In some patients, the germs are so powerful that the patient has to be shifted to ICCU, put on ventilator, dialysis has to be performed, and even after amputating the leg, the life of the patient cannot be saved.



In many patients, foot is deformed and fingers get distorted. In such circumstances, bones of the foot are straightened using screw and plate. In some patients, the part of the foot on which we stand, the ankle joint, is dislocated, due to which, when the patient tries to stand, the foot gets twisted, and it so happens that the patient cannot even stand. In such patients, joints are straightened using screw, plate and wire; otherwise the patient cannot walk on that leg. Sometimes, there are wounds in the sole that don't heal, for which certain bones of the foot, which pressurise the skin and don't allow the wound to heal, have to be cut.

For preventing frequent wound in the front-foot, sometimes the muscles of the lower leg have to be loosened in order to increase the movement of the foot and reduce resistance in walking.

When there is less circulation of blood in the vessels, operations have to be performed to increase the circulation. At times, some part of the blood vessel becomes narrow whereas all the other blood vessels are healthy. When the greater part of the blood vessel becomes stiff, instead of rubber tube, it becomes as rigid as a plastic tube.

Originating from heart, the aorta descends to the back of the chest cage and reaches the navel. From there, aorta splits into two parts, going to the right and the left, and then it slowly moves towards the thigh and lower leg. If there are clots in aorta or it becomes narrow, operations have to be performed

to clean them. A bypass surgery can also be performed by placing a plastic tube.

With the availability of modern facilities, a balloon can be placed in the leg without any operation through a wire to widen the blood vessels, just as a balloon is placed in heart to widen the blood vessels. This is called Angioplasty. By doing this operation, many legs can be saved from being amputated.

If the patient having pus/infection are not suffering from heart, kidney or breathing problem, apart from high diabetes, the operation is performed within 12-14 hours.

Applying thin skin on wound (plastic surgery):



*Plastic surgery/Skin grafting*

Generally, when the length and width of the wound is more, it takes time to heal. In such cases, no dressing can shorten the time taken for healing process. Mostly for sores of the size of 5 cm or more than that, applying new skin through a plastic surgery is advised. In a plastic surgery operation, only a few upper layers of the skin are taken and applied, so that the area from where they are taken is not affected.

After operation, if more part is left open without skin, so much more time it takes to get healed. Sometimes, instead of thin skin, thick skin, pedical graft can also be placed to heal the wound. Especially, when the joint or bone is open, this type of plastic surgery is needed.

In case of large wounds, when dressing is done for a longer period of time, sometimes, after 80% to 90% of healing, it stops healing. After this, no other option is left other than plastic surgery.

Sometimes, for the prevention of wound in deformed legs or fingers, plastic surgery is done to straighten them.

### **Principles of Treatment**

- Do not put weight on the foot with a wound.
- Control over diabetes and metabolism process.
- Injections for control of pus and infection.
- Keep legs elevated.
- Apply elastocrepe bandage.



- Stop movement of the leg.
- In case of a need of toe operation, save as much part of the toe as possible.
- If pus cannot be cleaned adequately and stitches are taken, it again increases from inside. Take stitches only as and when possible and indicated.
- To remove pus is a primary need. Do not cut less to take stitches.
- Start gradual increase in walking after getting healed.
- Do exercises without giving weight on affected foot. ■



## **TAKING CARE OF THE FOOT AFTER OPERATION**

When a patient's leg is cut from above knee or below knee, it generally takes 1-2 months to heal. The patient can't walk during that time period and due to this, he/she finds it difficult to control diabetes, can't have food properly, becomes psychologically weak and the heart becomes weak due to the lack of exercise. An important advice for such patients is to start walking with the help of a walker as soon as possible after the operation.

Another exercise that is suggested is to gently stretch hands and legs while sitting or sleeping and taking deep breath daily for 30 minutes.

After the healing of stitches, the artificial leg is made generally after 3 months because it takes time for the swelling to reduce after the healing of the stitches. If the artificial leg is made earlier, it becomes loose and can't fit properly. If there's financial convenience, the artificial leg can be made, and walking can begin after 1 month.

After 2-3 months, one needs to get a new artificial leg made. In developed countries, it is possible to get the patient walking through the artificial leg in just 2-3 days after operation. The

diabetic physicians as well as relatives of the patients believe that the patients of diabetes should walk to control diabetes. However, patients having corn or foot wound due to operation or amputated toe should themselves wear footwear that would protect the feet, and take sufficient care and walk minimum for daily activity till the healed wound becomes strong.

The foot wound only heals if one does not put pressure on the foot having wound. When a person's skin becomes thick like corn, it's obvious for him to have foot wound. Thick skin or corn is the first phase for foot wound. Therefore, such patients should perform other exercises and breathing exercises. Furthermore, they can do leg exercises by sitting or by lying down. But it is essential to do other exercises apart from walking at least for half an hour or hour, twice a day. ■



## REASONS FOR FOOT WOUNDS NOT HEALING IN DIABETES

We know that before the crops are grown, the farm has to be ploughed, and after sowing the seeds it becomes necessary to water them regularly, spray pesticides and remove the weeds. The process of healing foot wounds is a similar one. Antiseptics should be applied to the foot wounds to keep them infection-free and allow complete blood circulation in the area surrounding the wound. This provides nutrients for the healing.

If the red flesh comes above the skin, it should be scrubbed and washed properly. If the foot wound is healing properly, it should be covered with skin within proper time and plastic surgery should be done.

The level of sugar in blood is high in diabetes and in an increased proportion in various cells of the body.

Hence, it provides an active breeding ground for the germs in the wound which is referred to as infection or pus formation. This becomes one of the key reasons why wounds do not heal in diabetic patients.

Another reason is the lack of sensation of pain. A diabetic

patient does not experience pain in the foot like an ordinary person. The reason for this is problem in the nervous system. Pain works as a protection for the body. For example, if a small stone, thorn or nail pricks us while we are walking, we lift our leg up immediately. Even if there is a minor scratch or injury in the leg, we reduce the use of that leg due to the pain or ensure that we give proper rest to it.

As a diabetic patient doesn't feel pain, even if he suffers from a boil, injury or swelling in the leg, he does not take rest. It is not true for all but 70-80% patients do not feel the pain, due to which they are not able to protect their legs.

This way, they keep getting hurt on the foot wound, as a result of which, it does not heal.

In diabetic patients, the circulation of blood decreases due to which the process of healing is delayed or does not take place at all. In 20-30% of the diabetic patients, the decrease in blood circulation is responsible for amputation of the leg.

We know that taking rest is also necessary for the healing of foot wound. The painless movement of the joints of the leg is also a cause why the foot wound would not heal. As a plaster is needed to repair the broken bones, a plaster is also required for repairing the skin otherwise the foot wounds do not heal for a very long time.

In diabetes, the protein elements of the body are damaged. These protein elements are essential for the production of flesh, new blood vessels as well as skin cells. When the protein



elements are damaged, the process of healing becomes slow.

These protein elements also strengthen the joints. They also contribute largely in the process of healing. If there is lack of protein elements in the body, it causes several parts of the body to swell and the process of healing becomes slower.

For any foot wound to be healed, the cells of the body must grow and through cell division, new cells must continuously be produced.

In diabetes, the rate of cell division decreases or stops and hence the process of healing also becomes slower.

Generally, in patients who do not suffer from diabetes, these healed wounds are stronger and do not break easily even when they walk or run using that leg, but in diabetic patients, the healed wounds are also weaker and can break easily, as a result of which, multiple surgeries have to be conducted on the same leg again and again even after it has healed.

In diabetic patients, the legs become uneven, bones get damaged and the sole of the feet lose fat. Thus, the bones damage the skin and the weight of the patient plays a major role in it.

Thus, diabetes is an important factor in the delay in healing of the foot wounds. The age of the patient, the proportion of haemoglobin in blood, weakness in heart and kidney, lack of nutrition and decreased immunity due to diabetes are the other causes which have to be considered for healing in the diabetic patients. ■

## IMPORTANCE OF SHOES AND SANDALS IN DIABETES

The ability to feel sensation in the leg decreases due to damage of nerves in diabetes. As a result, the patient does not feel pain even when things like stone, thorn, nail or broken glass pierce the feet or they come in contact with hot or cold object. He keeps walking happily and does not feel the pain even when his foot is bleeding. He cannot feel the heat of a hot surface or floor at religious places like temple, mosque, derasar, church or on road or terrace



*Toe deformity due to wearing slipper or chappal*



*Footwear shape distortion due to deformed feet*



After being diagnosed with diabetes, it is advisable for the patient not to wear slippers or *chappa/s*. He should wear such

footwear that does not have toe bars. The footwear keeps coming out unknowingly and that's why the patient tries to hold it with the help of finger and toe. Hence the fingers and the toe are bent and it hurts like a hammer when the patient goes for a walk.

This process is so slow that the fingers keep turning crooked for 4-5 years and the patient does not even realize it.

Therefore, it is advisable that the patient wears such shoes, sandals or mojadi which do not have to be held from the middle and can protect the entire foot. Moreover, due to swelling in the leg, sometimes there is shoe-bite and hence it is advisable to wear loose footwear with velcro or lace.

### Inner Sole



*Foot impression to prepare insole*



*Foot-insole modification to prevent pressure on corns and wounds*



*Fillers in insole to prevent toe deformities after toes amputation*

Patients suffering from foot corn or deformed feet are advised to wear loose footwear which cover the entire foot. If the sole is hard, it is possible to have either a corn or the skin becomes harder or even a foot wound can be found where the bone pressures outside. After placing the insole, the footwear that is purchased must be bigger than the actual size of the foot. The patients having foot wound or cut, their sole is made in the machine according to the shape of the foot. This type of sole can be fitted in any kind of footwear.



*Halux vulgus splint*

In patients whose fingers or toes are cut, other fingers also become crooked according to the space. Thus, if the patient doesn't want the fingers to get bent or crooked on either side, the sole is raised or stuffed on that point. Thus, the remaining foot remains alright.

There are also soft substances like silicon available for the sole of the foot which can be placed in the shoes. Some patients, who feel pain in the ankle, are advised to put the silicon-like substance only for the ankle. It is advisable to wear cotton socks with shoes.



*Silicon insole*



*Silicon heel*



*Single and multiple silicon toe ring*



*Modified insole*

### **Outer Sole of the footwear**

Diabetic patients should wear the footwear having hard outer soles. In order to protect the foot from broken glass, thorn, nail or gravel, it is advised to wear the shoes/footwear having hard outer soles. Those suffering from foot wounds in their toes

are advised to wear shoes that can protect the wound from touching the ground.



*Felted foam adhesive dressing with a hole to remove pressure from ulcer area*



*Specialised footwear*



*Heel area pressure relieving footwear*



*Toe area pressure relieving footwear*

the same way, special kind of arrangement can be done in the bottom of the footwear for the non-healing foot wound to protect the foot from any pressure.

Generally, one should purchase footwear in the evening. After the activities of whole day, the people suffering from diabetes, high blood pressure and kidney diseases experience swelling

in the foot. If they purchase footwear in the morning when there is no swelling in the legs; whenever the swelling occurs in the evening after they have worked all day, these footwear might not fit perfectly, then causing several injuries or shoe bites on the foot . Thus, they should buy the shoes/footwear that can easily be taken out even if the foot is swollen.

Sometimes, children tend to put pointed or sharp objects in the shoes while they are playing. If these shoes are worn, it doesn't pain but the foot is injured inside and when we take off the shoes, we can find bleeding. Thus, we should always wear the shoes considering such things.



*Forefoot wide box is ideal*

Shoes bites are very normal. They can happen to anybody. In case of normal patients, they heal without any difficulty but in case of diabetic patients, they can worsen to an extent that the toe or leg might have to be amputated.

One should wear any new footwear only for shorter intervals until it gets older. Walking longer distances on new footwear may cause shoe bites. Moreover, diabetic patients should not walk too long. When a patient wears regularly one footwear and walks for 1 -2 hours there may not be a shoe bite, but when such footwear is worn to walk longer distances like 8-10kms, it can cause shoe-bites.



*Examine the shoe from inside to prevent foreign body injury*

It is advised that the diabetic patients have 2-3 pairs of shoes and the new footwear should be allowed time to soften and expand so that it's not needed to walk more with new pair of shoes.

It is not the best treatment to have special kind of footwear for any kind of foot wound. The foot wound should be healed first through other kind of treatment. One should wear appropriate kind of shoes/footwears to stop the wound from recurring.

Operated people also get such shoes/footwear that can be worn after dressing. In order to protect the healed foot wounds and stitches, it is required to have proper information about the shoes/footwear. As footwear/shoes are needed to protect the feet, immobilization (stopping movement) is also needed. As we need plaster to cure the broken bones, plaster or plaster-like structure is also needed to cure the foot wound around the joints. ■



*Any wound around a joint requires plaster immobilization to heal.*





## ARTIFICIAL LEGS AND OTHER EQUIPMENTS

In diabetes, when the joints of the ankle are damaged and get dislocated, it is not possible to stand on that leg. If we walk without protection with such a leg, the whole leg below the knee may have to be amputated. A simple shoe cannot protect this leg. A special type of shoe, which is made up of plastic and of the height of the knee, can hold the joints, can stop the leg from moving and save it from amputation. Sometimes, it is not possible to move the foot because of nerve problems. In such a situation, it is not possible to raise the foot or the toe from the floor (It is called foot drop).

The nerve problem can lead to such a situation even in non-diabetic patients. For this, special kind of footwear that can hold the foot above the ground or prevent the sole from touching the ground have to be made (foot drop splint).

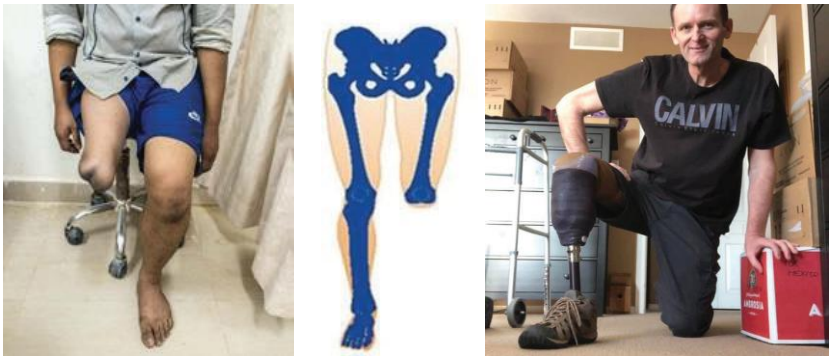
To make an artificial leg, there are three ways/possibilities-when the leg is amputated below the knee joint, when the leg is cut from the knee joint and above the knee joint.

When the leg is amputated from below the knee joint, an artificial leg can fit well if usually the portion of 6-7 inches from

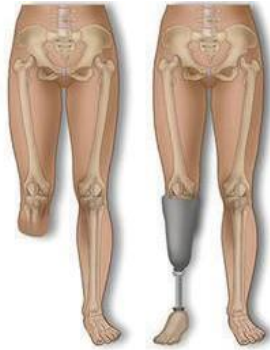
the knee joint is saved. If the leg is amputated longer than that, i.e. near the ankle, the artificial leg does not fit well.



*Amputation above knee and patient with artificial limb*



*Amputation through the knee joint and artificial limb*



*Amputation below the knee joint and artificial limb*

Generally, there are less cases of operation where the leg is amputated right from the knee joint. Therefore this kind of artificial leg is also found very less.



*Artificial foot*

For surgeries that involve the amputation of legs above the knee joints, it is advisable to do so while keeping most part of the thigh longer and intact.

An artificial leg should generally be made after 3 months of amputation. The most important thing is when the patient walks with the support of an artificial leg, he has a fear of falling. For this, he should first be trained to walk using the support of a stick or walker, following which he can gradually start walking like a normal person.

Artificial legs are available also for the patients without a knee joint. The patient, on wearing such an artificial leg with an artificial knee-joint, can walk normally and even sit cross-legged. These days, artificial legs are even light weighted.

There are arrangements like spring in the foot and artificial leg can stay intact with the amputated leg without a bandage.

Moreover, the walking speed can also be set and adjusted in the knee joint of artificial leg. The patient can even run and ride a bicycle along with other activities, wearing an artificial leg.

Just as sweetness depends on the amount of jaggery added, the facilities available in an artificial leg depend on the money invested. The price of such legs varies from Rs. 20,000-25,000 to Rs. 5,00,000. They provide strength to the patients to live without any kind of dependence. ■



## INSULIN AND HEALING PROCESS

Generally, people avoid taking insulin injections and there is a perception that once they start taking these injections, they will have to take them for the rest of their lives. But in several patients, insulin injections can be stopped after the treatment of their feet is over. However, if diabetes is not under control or organs like kidney, heart or eye are damaged due to it, then the doctor advises to continue taking insulin injections.

When there is formation of pus on the feet, if the doctor advises to take insulin, one should definitely do so in order to prevent pus and save the foot from being amputated. The sugar levels can be controlled more quickly with insulin injection. Its dosage can be changed 3-4 times a day. In addition to that, it is also useful in healing

Some doctors apply insulin on wounds and believe that it is a good curative. But the use of insulin on wounds is rare.

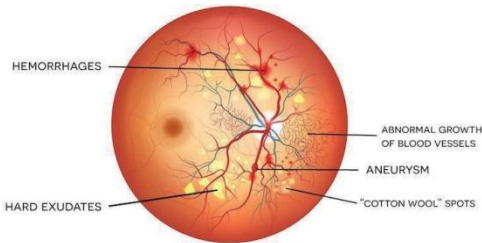
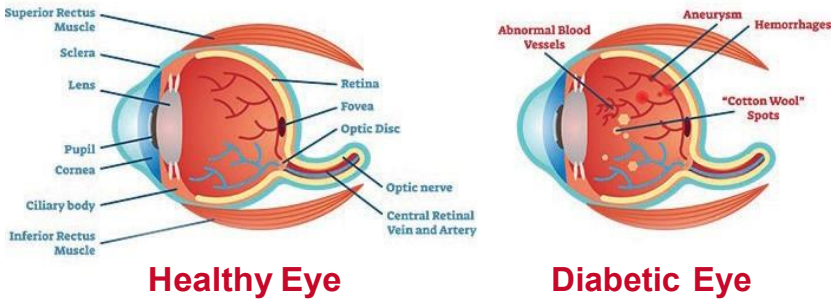
Insulin also plays a beneficial role in nerve diseases. For patients who experience burning sensation or tingling in the feet, if provided with insulin, the damage to the nerves in the initial stage can be reduced. It is the best drug to protect the feet. After the surgery, when the foot is healed, if diabetes can be controlled by oral medication, intake of insulin injections can be stopped.

Many a time, patients having foot problems also tend to suffer from kidney, heart, or liver diseases. It is advisable for them to take insulin injections even if oral tablets for diabetes can keep their diabetes in control.

Insulin injection can be given 2-4 times a day as per the need. But if the patient is serious and admitted in ICCU, insulin must be injected or sometimes pumped as well. To save life, insulin must be taken where needed. ■

# HEART, KIDNEY AND EYE PROBLEM IN DIABETIC FOOT PATIENTS

We know that diabetes is one such disease that damages all the cells of the body and also important organs like heart, kidney, liver, eye and foot. The blood vessels present in the retina of the eye get torn, leading to retinal dysfunction. Gradually, the eyesight starts to get blurred resulting in blindness. Often, the patient experiences loss of vision and thinks that it is because of medicines, but that is not so. It is because of diabetes.



*Diabetic retinopathy*

Inadequate blood circulation in the heart is a problem which is related to heart disease. In many patients, lack of blood circulation and a slight pain in the chest is observed. It occurs due to dysfunction in the blood vessels. Most of the patients could be treated for longer duration through the medicines that thins out the blood or by providing other medical treatments. Diabetes often causes heart attack without any observable pain in the chest resulting in untimely death. Such heart attacks that occur without chest pain are called silent heart attacks. This problem occurs due to decrease in circulation of blood to the heart. Diabetes also causes damage to muscles present in heart wall in addition to decreased circulation. This is referred to as Cardiomyopathy. This cannot be treated by operation, nor can it be treated by fixing balloon or stent in the blood vessels or by bypass surgery.



*Wall of a normal heart*



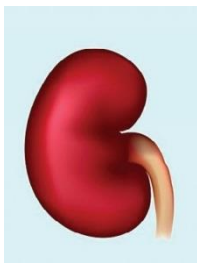
*Thick wall of a diabetic heart*

In diabetic patients inadequate blood circulation can be treated by inserting balloon and stent but when the heart wall weakens, none of these methods is helpful. The patient experiences shortness of breath and congestion in the lungs

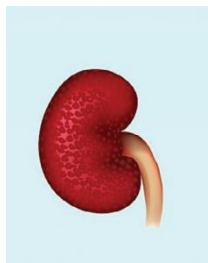


and this is called heart failure. All this happens due to diabetes.

Both diabetes and blood pressure damage the kidney. The sugar that is released from the kidney and removed through urine destroys the blood filtering tubes preparing urine present in the kidney. The damage caused by blood pressure to kidney is much more than the damage caused by diabetes. And when the kidney gets deteriorated beyond some extent, then even if the diabetes is under control the condition of kidney will not improve. It becomes necessary to undergo dialysis for a long time. 50-60% of the patients undergoing dialysis are diabetic patients. It becomes necessary to treat the patient for blood pressure along with diabetes.

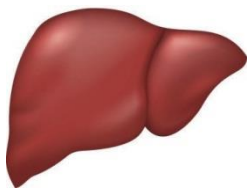


*Normal Kidney*

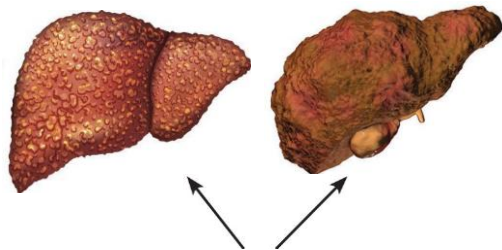


*Diseased Kidney*

Just as the kidneys are damaged, so also the liver is damaged. Chronic liver damage gives rise to problems like fluid build-up in the belly and vomiting of blood.



*Normal liver*



*Diseased liver*

Patients with problems in the leg and who also suffer from diseases of heart, kidney and liver face problem in healing of wounds. Minor foot ailments become bigger and it may so happen that instead of operating a finger an entire leg has to be amputated. This means that in the treatment of diabetic patients the result does not depend only on keeping diabetes in control. Many other factors contribute to saving the leg from amputation. ■

## INCORRECT HOME REMEDIES FOR FOOT WOUNDS

People tend to use various remedies to cure wounds. Some people apply various types of herbal pastes on them. Some people, for preventing the pus from worsening, also tie a peacock feather, tight piece of cloth or black thread.



*Blind faith in peacock feather*

The understanding behind this is that poison can be prevented from spreading further if the leg is tied tightly. However, that is not true. Sometimes, the disease, instead of getting better, worsens and can lead to amputation of the leg.

Many people also apply coal powder or toothpaste to it. But it is highly advisable not to use such remedies and instead, apply scientifically developed medicines. In the olden times, when science had not advanced, people used to apply milk, honey, wine and several types of oils on wounds.

People also apply their own urine and saliva. The factors responsible for such home remedies are illiteracy and half knowledge. Saliva and urine do consist of certain elements that are beneficial in healing the wound but, there are also good medicines available that contain these elements that are present in urine and saliva. Many people apply things like turmeric, ghee and tea powder. They are inappropriate too. Turmeric is an antiseptic but there are even better medicines available.

The easiest and handy remedy to stop bleeding is applying turmeric powder, which people have been doing for years. But it is not advisable for diabetic wounds.

Similarly, it is not advisable to apply foam producing medicines on dressing regularly (Hydrogen Peroxide). Such medicines should be used only as per a doctor's guidance.

Some people also get treated with leech therapy and fish therapy, but it cannot be said when such treatment would have an adverse effect in diabetes. ■



## **MISCONCEPTIONS /WRONG BELIEFS ABOUT FOOT WOUNDS**

Diabetic patients, suffering from wounds in the leg come with lot of misconceptions in mind, like:

1. Leg should not be washed with water
2. Not to eat sour food
3. Not to drink milk
4. Walking is must in diabetes

### **1. Leg should not be washed with water**

The patient may have the wound lasting for long period of time and over the period of 2-3 months he might have the medicated dressing with blood and pus. If such a patient does not wash his foot with water over a certain period of time, the uninfected skin too gets damaged and becomes papery and dry.

So, the patient whose dressing lasts for long time, should wash the leg every few days before dressing and an ointment should be applied on the uninfected skin in order to soften it around the wounds.

The dressing cannot be kept wet and the feet cannot be soaked in the water for a long time but it can certainly be cleaned with water.

## **2. Not to eat sour food**

Diabetic patients with wounds assume that eating sour food would delay the healing process. But this belief is completely wrong. In diabetes, things like sweets, rice, potato and oily foods are prohibited but there is no problem in eating sour things.

Vitamin-C tablets are available for healing. This vitamin is obtained from sour things and is helpful in healing process. Thus, the patients with wounds can definitely have things like lemon, buttermilk, tomatoes, etc.

If the patient is allergic to sour things or if it leads to swelling, he should avoid eating sour things.

## **3. Not to drink milk**

Diabetic patients should drink milk irrespective of whether wound is there or not. It is advisable not to consume creamy milk. Otherwise, milk is the perfect diet for obtaining calcium and nutrients.

## **4. Walking is must in diabetes**

When diabetes is diagnosed and the doctor starts the treatment, he explains three things to the patient:

- Diet advise
- Compulsory walking
- Taking necessary medicines

This instruction is completely true in diabetes but the patients with corn or foot wound should avoid walking.

However sometimes it so happens that when patient with wounds in his feet goes to a physician for diabetes, he does not provide information about the wound, so the physician may give strict instructions that walking is must and if he does not walk, it would become difficult to control diabetes. The wounds of such patients may not heal and sometimes such a situation can lead to the amputation of leg.

Still, if walking is necessary, the patient should wear such footwear that can protect the injured foot and should not walk for long time as a part of exercise.

There are many exercises that the patients with foot wounds are advised to do apart from walking. These are doing asanas, breathing exercise, hand exercise while sitting, leg exercise while lying down and sitting, and also cycling. It is beneficial to do such exercise for 30 minutes or an hour till there is perspiration. ■

## TAKING CARE OF YOUR FEET

Diabetic patients, their family members, family doctors, physician, and a diabetologist should regularly keep checking feet of the patient.

The patient himself should definitely have a regular check-up of his feet. During this check-up, they should take note of the swelling of legs, condition of nails, skin between two fingers, any injury or spots on the sole, corn, cracks on the heels and changes taking place in the shape and size of the feet.

Sometimes, it so happens that patients are unable to or find it difficult to have a look at their own feet due to pains in back or foot joints or excessive fat present in area near the belly. Such patients should ask either one of their family members or colleagues to have a regular check-up of their feet.



*Self-examination of foot with the help of a mirror*

Patients who are suffering from diabetes but do not have any problem with their foot should, at least once or twice a year, get feet check-up done by



an expert. Patients suffering from any kind of disease related to feet, having foot wound, corn, deformed or operated foot should unfailingly meet an expert every 2-3 months.



*Examination of blood supply in the foot*

Patients having sudden pain of ankle while walking, burning sensation in the toes or foot, sleepless nights due to severe leg pain, etc should immediately consult an expert. Some kind of injury, loss of blood, pus or foul smell coming from foot, observation of such symptoms calls for an immediate measure, i.e. consulting a doctor. The first thing that the patient must do is to stop walking and to take rest.

Swelling in legs could be a result of diabetes, blood pressure, heart diseases etc. Elderly people might face this without any particular reason. People, who keep their feet and legs hanging for a long time while sitting, also might get swelling. If the impure blood in the blood vessels does not reach back to the lungs properly, swelling of legs is possible even then. It is also seen in people who have got their knee, hips or joints operated.

Swelling in just one leg is more serious than swelling in both the legs for diabetic patients. This should be taken into consideration immediately and the patient should seek the advice of the doctor.



*Swollen left foot*

Diabetic patients are strictly advised not to wear slippers or chappals. Instead, they should wear such footwear that covers their feet completely, both inside and outside the house. They are also advised to wear cotton socks. They should not cut their nails

too deep, otherwise the skin near the nails could get hurt and cause pus.

In diabetes, sugar present in the blood denatures the protein element, which is necessary for strength of joints and structure of the muscles. Its denatured protein causes stiffness of the joints, their lesser movements and as a result, wounds and corn in the feet. Therefore, diabetic patients should regularly give exercise to the toes and the space between two fingers should always be kept dry.



*Nail problem in toes*

During monsoon, moisture in the air may cause fungus in the space between two fingers. Many people suffering from diabetes have a higher frequency of urinating due to which

their feet get wet more often. Due to this, the chances of fungus increase. Hence, patients who have the tendency to wash their feet frequently, working in water or in humid atmosphere for a longer period should specifically keep the space between the two toes dry and apply powder.



*Fungal infection  
between toes*

In summer, when patients visit religious places like church, temple, mosque etc, they cannot feel the burning sensation of the hot ground in their feet. During summer, the terrace, steps, compound etc of the house often get heated. Walking on it will obviously burn the feet. When in a trip or visiting some crowded tourist spots (e.g. Taj Mahal, Lotus Temple, museums etc), patients have to wait in the queue or have to walk a long distance. During this time, they have to walk or stand on the hot steps or tiles, which causes blisters in their feet. So, it is advised that, the patients wear thick cotton socks not just on their trips but also when they are at home. This prevents the burning of the feet. Moreover, it is recommended to wear footwear while walking rather than walking bare feet.



*Burnt feet due to walking on hot surface*

During winters, the skin gets dry which causes cracks in the heels leading to pus. This also happens due to lack of perspiration because of nerve problem. To prevent cracks in the heels and keep the skin smooth, apply any kind of oil, Vaseline or lotion gently on feet and wear socks and shoes. This prevents the skin from getting dry.

When it's too cold in winters, patients, in order to keep their hands and legs warm, may sit near the fire. Since the patient may be able to realize the heat felt to hands, he may remove them immediately. But the feet can't feel the heating sensation. In case of the feet, the patient does not take his foot away from the fire, until there are blisters on the foot and they get heated up too much. The room heaters also function similarly. If the patient has his feet near the heater, he might not even feel that his foot is burnt.



*Heel fissure in winter*



*Fissure getting infected*

Thus, through regular check-ups, applying cream regularly to keep the skin smooth and soft, taking care of the feet keeping each season in mind and very carefully cutting the nails of the toes, diabetes patients can prevent problems related to feet and legs. If the patients have any kind of confusion or questions related to this, they should immediately consult and seek advice from a surgeon specializing in leg problems. ■



## **ADDICTION AND PROBLEMS INTHE BODY**

Consumption of alcohol, tobacco, cigarettes etc, is highly injurious to health and causes many problems. And even if we exclude the financial problems caused by these addictions, it has an adverse effect on the health to a great extent. The following are the diseases or disorders caused by smoking:-

Respiratory diseases - like dry cough, asthma and lung cancer.

Reproductive disorders - Due to smoking, there is decrease in sperm count in males and estrogen hormone in females, which affects the capability to reproduce. Furthermore, this also increases the chances of miscarriage in women.

Damage to eyesight- The blood vessels in retina gets dried up which causes blurred vision. In addition to that, one faces the problem of cataract quite early than usual and faces the problem of drying of tears i.e., Dry Eye Syndrome. The presence of Arsenic, formaldehyde and ammonia in the smoke from cigarettes, mixes with the blood and damages the eyes.

Problems in legs- The smoke from cigarettes narrows the blood vessels in the body due to which, the circulation of blood in both hands and legs decreases. In a diabetic

person, this plays a major role in development of gangrene due to which the patient might even have to get his leg amputated.

Heart diseases-The discharge from adrenal glands increases in people who smoke, due to which, the cells present in the blood vessels stick to one another and this leads to thickening of blood. This also increases the fat deposits in the blood vessels. Therefore, the walls of the blood vessels get thicker, increasing the chances of heart attack.

Along with smoking, tobacco is also equally harmful. People consuming tobacco are not only prone to diseases caused in the mouth and the inner skin of the mouth but also face the problem of narrowing of blood vessels due to an element called nicotine. Addiction to alcohol also causes severe damage to heart, blood vessels and liver.

Intoxicants like cigarettes, tobacco and alcohol work as boosters in already adversely affected heart, liver and blood vessels due to diabetes in diabetic people. Passive smoking or second hand smoking too is harmful for diabetic person, even if he doesn't have any addiction.

General estimations suggest that the addiction to cigarettes and tobacco is more harmful to the foot in diabetes and might result into amputation of the leg. ■





## PSYCHIATRIC TREATMENT AND REHABILITATION

The problems that are caused in the leg due to diabetes completely shatter the patient and his family members physically, mentally and financially. Also, they take a long time to cure and meanwhile, the patient can't resume his work. Thus, he is affected from all sides. If a situation arises where the patient has to get his leg amputated, his morale is completely shaken. A psychiatrist is needed to maintain the mental health of such a patient. The family members also have to look after him/her sympathetically.

The patient whose leg or a part of the leg gets amputated faces problems in moving around at home, wearing his clothes and doing other routine activities.

In fact, when any part of the leg has to be amputated by operation, it is necessary to study physiological as well as social aspects, patient should visit a place where artificial leg is manufactured and interact with other patients wearing artificial leg.

It is also important that the patient is made to realize about the significance of exercise after operation, trained for becoming self-dependent and performing his own tasks, practicing



various exercises including those for the knee joints and the knee caps.

With this, the patient should be taught to take care of the normal leg so that it doesn't have any problem. As soon as the patient gets a little better, he/she should immediately be taken to a physiotherapy centre, where he/she can get proper exercise. It is also advisable that the patient gets back to his/her job/business as soon as possible.

In this way, the treatment of the leg doesn't include just the treatment given by the surgeon. Experts from different medical fields have to look after the patient, which includes diabetes expert, physician, cardiologist, foot surgeon, physiotherapist, psychiatrist, artificial leg experts, counsellor etc. A patient who has got his leg operated can lead a good life only when all of them contribute their best. ■



## IMPORTANT INSTRUCTIONS

Clean your feet daily with water. If the foot is operated and undergoes dressing everyday, the foot should be cleaned regularly before the dressing.

- It is advised not to use concentrated Dettol or Savlon to clean foot sores because it can cause eczema.

During winters, the skin should be kept soft and moisturized by applying Cream, vaseline or oil, otherwise it may lead to fissures in the foot which will later get infected. Diabetic patient should avoid using too hot water to wash feet and bonfire should be avoided.

In summers, socks should be worn everyday and it is not advised to walk bare foot. It will cause boils. In the religious places too, one should not walk bare foot. It is recommended to wear cotton socks.

- In the season of monsoon, the space between two fingers should be kept clean and dry on a regular basis otherwise it might cause fungus.

Consumption of alcohol, cigarettes and tobacco and other intoxicants should be stopped otherwise it creates the possibility of gangrene in foot.

Sharp objects like blade, pocket knives etc should be avoided for cutting nails. Also, nails should not be cut too deep, otherwise the corners of the nails of the toes of the feet would hurt and cause pus.

- Patients should avoid leaving their legs hanging while sitting as it may cause swelling especially the patients who face regular issue of swollen leg.
- Diabetic patients should wear specially designed footwear both inside and outside the house to avoid any kind of injury. It is advised to wear only shoes or sandals.

Diabetic patients, who do not face any kind of issues with leg and foot, should get a check-up, at least once in a year.

- Patients should themselves check the bottom of their feet regularly. If they are not able to, they should do it with the help of a mirror.
- Patients, who have been operated, should get a check-up, every three months.

Until the doctor instructs otherwise, the patient should not walk with recently operated leg.

- Patients with deformed or operated foot should wear specially designed footwear otherwise can cause frequent foot sores or delays the healing of the sores.
- Patients with foot sores should avoid walking as the foot sores will stop healing due to the pressure on it. Such

patients are advised to try exercises that can be done while sitting. For e.g. pranayama, yoga and various hand exercises.

- Edibles like lemon, tomatoes, gooseberry, guava, curd, buttermilk etc contains Vitamin-c. diabetic patients should use them as it prevents infection and also helps in healing of foot sores. ■



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