

## DIABETES MELLITUS-FOOT EXAMINATION FOOT EXAMINATION - CHECKING THE RISK OF DEVELOPING A DIABETIC FOOT ULCER

U. POONGODI<sup>1</sup> & KALANITTHI<sup>2</sup>

<sup>1</sup>Nursing Supervisor, K.H.M Hospital, Chennai, Tamil Nadu, India

<sup>2</sup>Managing Director K.H.M Hospital, Chennai, Tamil Nadu, India

### ABSTRACT

If a person already has a diabetic foot ulcer, the danger is clearly there (although sometimes both the patient and the doctor can be fooled because there is no pain). The need for treatment of the ulcer by a multi-disciplinary approach involving doctors, podiatrists and nurses is also well established. It is a different type of challenge to identify the patients before they have actually developed an ulcer so that they can receive appropriate footcare education.

In a sense every person with diabetes has increased risk of developing foot ulceration and needs to take precautions to prevent it from occurring. However, some people have very low risk and some people have very high risk. Grading the risk helps the individuals and the health professionals to take appropriate measures without being too relaxed or too strict. This is not only good for the individuals, it also helps to direct valuable health care resources to people who need it. Patients at low risk only need general advice. Patients at high risk need detailed, specific and practical footcare instruction.

**KEYWORDS:** Diabetes Mellitus-Foot Examination Foot Examination - Checking

### INTRODUCTION

#### Risk Factors

The overall risk of an individual developing a diabetic foot ulcer is determined by a combination of factors. In general, the risk is higher if:

Neuropathy is more severe (because more sensation is lost)
Peripheral vascular disease is more severe (because there is less circulation to bring enough oxygen to repair tissue damage)
There are coexisting abnormalities of the shape of the foot which make the local effects of neuropathy or vascular disease more severe (because it increases local pressure and callus)
The person is unable to practise reasonable self care to maintain general condition of the feet and to prevent trauma (because there are more chances of damaging the feet)
The diabetic control is very poor (because of susceptibility to infection and poor wound healing)
There is a past history of foot ulceration due to diabetes (because the above factors often persist)

#### Diagnosis

There are many different methods of diagnosing and grading diabetic neuropathy. This section concentrates on the practical aspects of grading neuropathy for the purpose of assessing the risk of developing a diabetic foot ulcer.

The most important aspect of grading diabetic neuropathy from foot ulceration point of view is to assess the degree of loss

of sensation in the feet. Doctors usually do this by testing if the patient can feel the pain of a pin prick or the touch of a cotton wool or the vibration of a tuning fork.



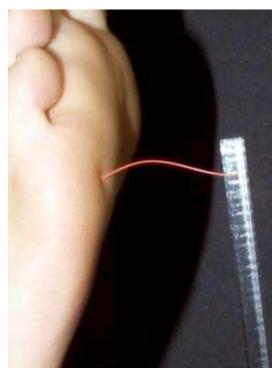
These are perfectly useful and time honoured techniques. However, the problems with testing sensation with a pin prick; cotton wool or tuning fork is that every doctor does it in a slightly different way. It is very difficult to standardize the procedures and the results. To overcome these problems, two other methods are often used :

- Testing vibration sensation with a biothesiometer.



A probe is applied to part of the foot, usually on the big toe. The probe can be made to vibrate at increasing intensity by turning a dial. The person being tested indicates as soon as he/she can feel the vibration and the reading on the dial at that point is recorded. The biothesiometer can have a reading from 0 to 50 volts. The reading is low in young normal individuals (ie. they are very sensitive to vibration). As we get older, the biothesiometer reading becomes progressively higher. From experience, it is known that the risk of developing a neuropathic ulcer is much higher if a person has a biothesiometer reading greater than 30-40 volts, if the high reading cannot be explained by age.

- Testing touch pressure sensation with a monofilament



A standardized filament is pressed against part of the foot. When the filament bends, its tip is exerting a pressure of 10 grams (therefore this monofilament is often referred to as the 10gram monofilament). If the patient cannot feel the monofilament at certain specified sites on the foot, he/she has lost enough sensation to be at risk of developing a neuropathic ulcer. The monofilament has the advantage of being cheaper than a biothesiometer, but to get results which can

be compared to others, the monofilament needs to be calibrated to make sure it is exerting a force of 10 grams.

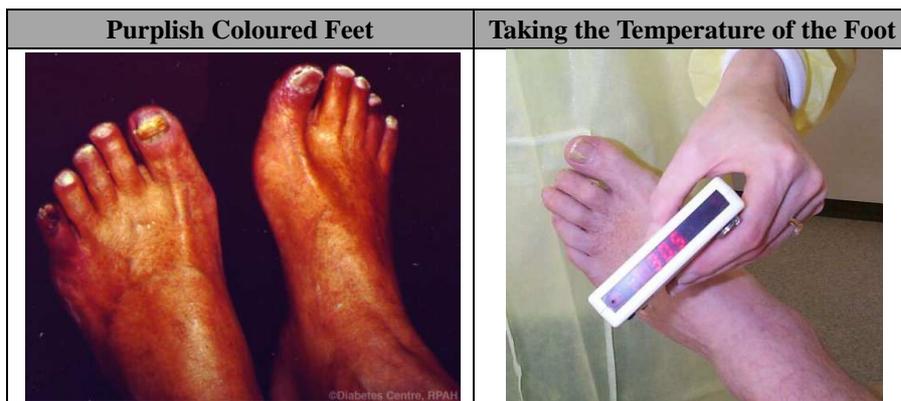
Overall if a person has a high biothesiometer reading (eg. 40 volts) and cannot feel the monofilament, there is a high risk of developing neuropathic ulceration especially if some of the other risk factors listed above are also present. For these individuals, intensive foot care education is required. On the contrary, if a person has a low biothesiometer reading (eg.10 volts) and can feel the monofilament, the risk of neuropathic ulcer is low, especially if none of the other risk factors are present. For these individuals, only simple footcare advice is required.

**The Presence or Absence of Pain is Not a Major Factor in Determining the Risk of Neuropathic Ulceration**

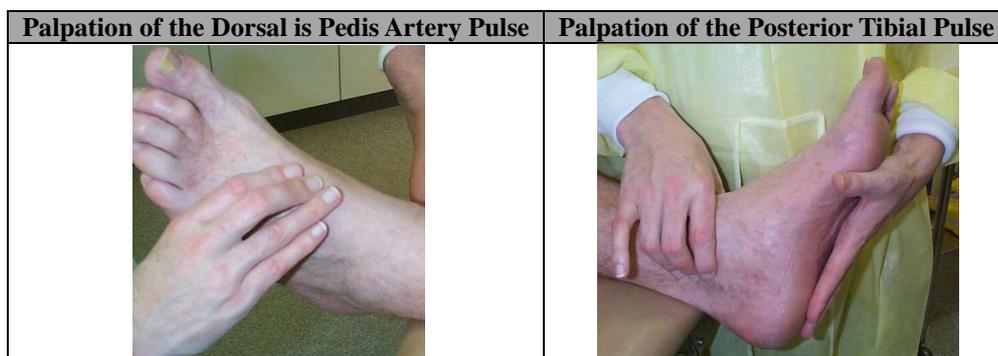
If a person has claudication or rest pain (especially the latter), there is sufficiently severe peripheral vascular disease to predispose to vascular ulceration.

If a person has no claudication or rest pain, then one relies on physical examination and, if necessary, investigations to determine the risk.

Looking at the feet to see if they are purplish in colour and feeling them to see if they are cold give important clue that the circulation may be impaired.



If pulses in the foot can be clearly felt, the risk of foot ulceration due to vascular disease is small. Pictures' showing the anatomical positions of the dorsal is pedis and the posterior tibial arteries



In most cases, looking at the feet and palpating the foot pulses are all that is required to assess the risk of vascular ulceration. When the foot pulses are very weak or not palpable, then it is necessary to carry out "non-invasive vascular tests" to assess the risk.

This is most easily done by measuring what is called the Ankle Brachial Index. It is as easy as having blood

pressure checked although a simple hand held Doppler machine is required for this. The following steps are involved :



Taking blood pressure in the arm This is called the brachial pressure because the artery being measured is the brachial artery.



Taking blood pressure in the ankle This is called the ankle pressure because either of the two arteries in the ankle can be measured.

**A Couple of Examples for the Calculation of the Ankle Brachial Index**

Lets say someone has a brachial pressure of 120mmHg and an ankle pressure of 132mmHg.

- Ankle brachial index =  $132 / 120 = 1.1$
- Lets say someone has a brachial pressure of 120mmHg and an ankle pressure of 96mmHg
- Ankle brachial index =  $96 / 120 = 0.8$

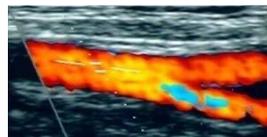
The following can be used as a guide to interpreting results of ankle brachial index:

**Table 5**

Normal	0.9 - 1.2	Risk of vascular foot ulcer is small
Definite vascular disease	0.6 - 0.9	Risk of vascular ulcer moderate and depends on other risk factors
Severe vascular disease	Less than 0.6	Risk of vascular foot ulcer very high



Sometimes the arteries in the ankles are calcified due to diabetes (blue arrows). This makes measurement of blood pressure at the ankle unreliable. In this situation, more information is obtained by measuring pressure at the toe. As a guide, a toe brachial index less than 0.5 indicates the presence of peripheral vascular disease



A duplex scan When it has already been established that there is significant vascular disease, a duplex scan can be performed to locate the blockage and assess its severity. A duplex scan is a combination of an ultrasound test and a Doppler test and is again non-invasive.

Overall, if a person has good strong foot pulses the risk of developing a vascular ulcer is small. In doubtful cases, measurement of ankle brachial index gives useful information.

Like any other part of the body, our feet can have some minor variations in shape from one another.



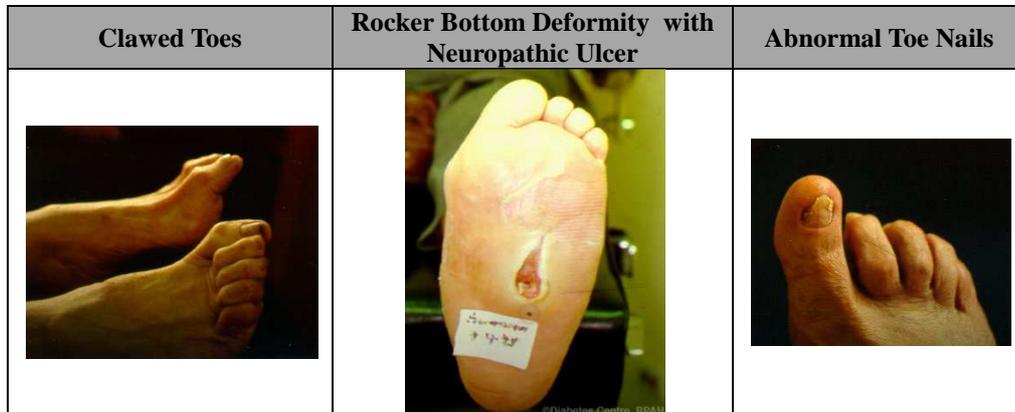
Sometimes, the foot shape abnormality is part of the diabetic neuropathy or other disease processes. Some of the abnormalities are:

- Clawed toes
- Rocker bottom
- Abnormal toe nails

Clawed toes occur as a result of imbalance of the muscles in the feet due to diabetic neuropathy. This increases pressure at the tip or apex of the toes. In the presence of neuropathy, these sites become ulcer prone.

Rocker bottom deformity occurs due to Charcot's joint which is a complication of diabetic neuropathy Toe nails can become infected, thickened and deformed

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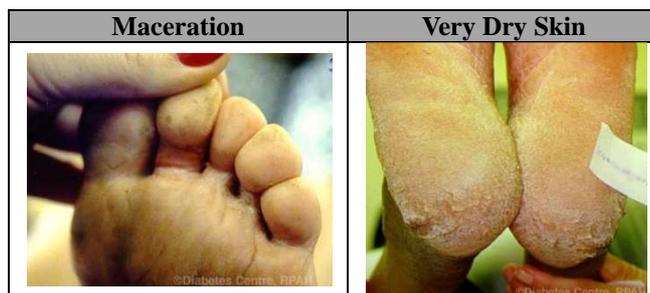


**Poor Diabetic Control**

Poor diabetic control increases infection and impairs wound healing. Although it is not possible to be absolutely clear cut, by and large it is the person with very poor control (eg. HbA1c greater than 10%), that is most at risk. Therefore even if diabetic control cannot be made excellent, it is worthwhile improving it to a level that is not "very bad". Also remember that even excellent diabetic control by itself will not be able to completely prevent foot problems once severe neuropathy or peripheral vascular disease is established. Other preventive and treatment strategies outlined in this document are still important.

The more care that is taken to prevent foot trauma and to improve foot hygiene, the more chance there is to avoid foot ulceration. Some of the problems due to poor foot care are:

- Maceration between the toes which can lead to infection
- Very dry skin with cracks predisposing to infection



Children or young adults with Type 1 diabetes are not at great risk of diabetes related foot problems in the early years as their nerves and blood vessels will not have been severely affected by diabetes. They should be encouraged to play sports or undertake the activities they normally do. There is no reason to stop any activity after being diagnosed with diabetes for fear that it might hurt the feet. As the duration of diabetes becomes longer (eg. greater than 10-15 years) and the person becomes older (eg older than 40-50 years), progressively more care is required.

People with Type 2 diabetes can get foot problems even soon after diagnosis because they might have diabetes for a long time without knowing. Circulation and nerve function are also not as good in older people.

## **CONCLUSIONS**

The patient with diabetes should undergo regular foot examination once (or) twice in a year in order to prevent and control the peripheral neuropathy and foot ulcer.

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