

Game changers in type 2 diabetes Amputations

PAT PHILLIPS MB BS, MA(Oxon), FRACP, MRACMA, GradDipHealthEcon(UNE)
ANGELA EVANS PhD, GradDipSocSc, DipAppSc

Any amputation in a person with diabetes is a risk factor for further amputation and also increases mortality risk. Increased attention to the medical and foot risk factors for diabetes complications can help prevent both ulcer development and subsequent amputation.

MedicineToday 2013; 14(6): 63-66

The statistics on the frequency of lower limb amputations in people with diabetes and the outcome for individuals who have had an amputation are scary. Twelve leg amputations occur in Australia every day, an estimated 4200 Australians lose part of their leg every year, and half of these amputations are above the knee or between the knee and the ankle (see the box on this page).¹ Major (above-knee or below-knee, but above the ankle) and minor (below-ankle) amputations both confer a risk of further amputation to the same or other leg and a mortality risk worse than that of many cancers. Individuals who have had an amputation face a new disability, new difficulties in working, relating to their community and living with their family, and new uncertainty about their future. Their GPs face the major challenge of managing these issues and of trying to prevent another diabetes disaster.²

This article reviews the incidence of leg amputations related to diabetes and the trend for the future. Risk factors and precipitating factors for amputation, the risk of further

amputation and the increased mortality that applies after an amputation are discussed, as is the use of active multidisciplinary care to prevent further serious complications. The article is the fifth in a series reviewing clinical situations that indicate a major change in the risk of diabetes-related complications and prompt the need for a major review of diabetes management.

CAUSES OF AMPUTATION

The causes of amputation in people with diabetes can be divided into two groups: those increasing the risk of a foot problem and those precipitating a problem in people at risk. Usually both a risk

LOWER LIMB AMPUTATIONS IN AUSTRALIA¹

- An estimated 4200 amputations per year in people with diabetes*
- Expected increase of about 30% every 10 years
- A person with diabetes has a lifetime risk of developing a foot ulcer of one in six, and an annual risk of leg amputation of about 1%
- Half of those who have an amputation will have a further amputation
- The five-year mortality for those who have leg amputation is 40 to 80%

* Based on data in reference 1 and projected increase.

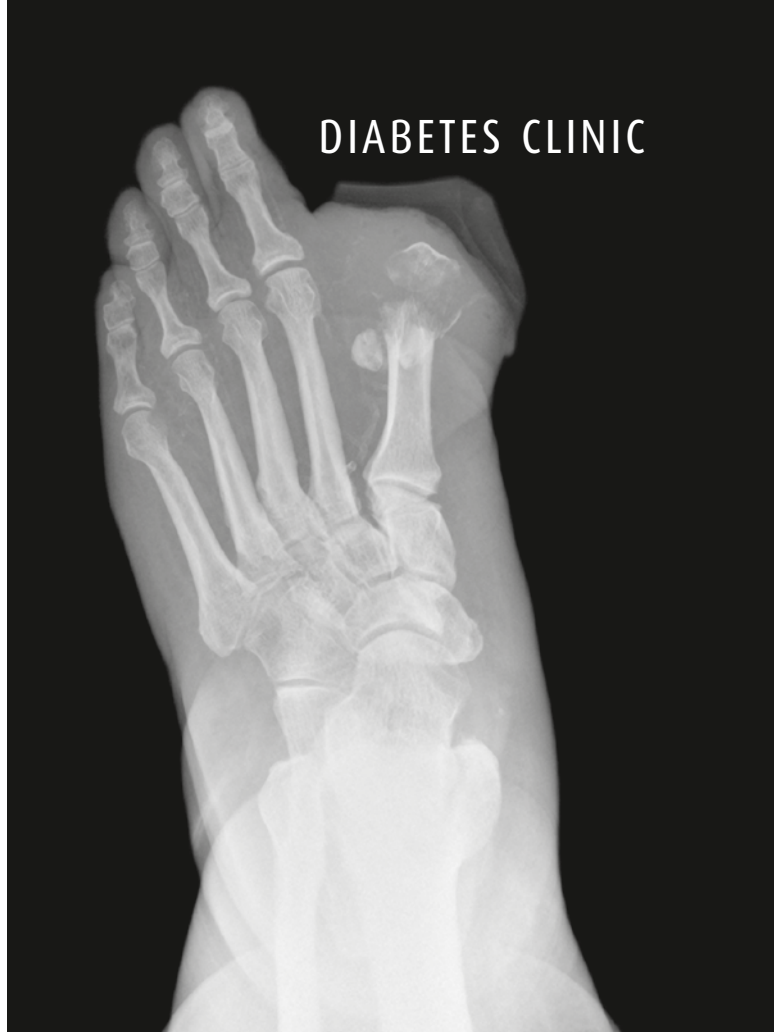


TABLE 1. FOOT RISK FACTOR ASSESSMENT IN DIABETES: THE TRAFFIC LIGHT GUIDE^{3*}

Foot risk factor assessment			
Foot factor	Foot factor 'traffic lights'		
	Red light – Danger	Amber light – Caution	Green light – Healthy
Anaesthesia (neuropathy) – Pinprick, light touch (e.g. 10 g monofilament) – Reflexes	No stimuli felt No reflexes	Reduced stimuli Reduced reflexes	All stimuli felt Normal reflexes
Blood (peripheral vascular disease) – Pulse palpation	No pulses	Reduced pulses	Normal pulses
Care [†] – Questioning – Observation	Inadequate foot care, inappropriate footwear [†] Skin breakdown	Foot care, footwear could be better Threatened skin breakdown	Appropriate foot care, footwear Normal skin
Structure (foot deformity) – Observation	Weight-bearing ulcer	Callus or corn	No skin lesions
Patient risk and response			
Traffic lights	Risk assessment	Recommended action	
One or more red lights	High risk	Refer to a podiatrist or high-risk foot care clinic	
One or more amber lights	Moderate risk	Regular podiatry care and assessment	
All green lights	Low risk	General foot care advice	

* The traffic light guide to foot risk stratification is consistent with the NHMRC recommendations for stratifying foot risk:¹

- low risk – people with no risk factors and no previous history of ulcer/amputation
- intermediate risk – people with one risk factor (neuropathy, peripheral artery disease or foot deformity) and no previous history of ulcer/amputation
- high risk – people with two or more risk factors (neuropathy, peripheral artery disease or foot deformity) and/or a previous history of ulcer/amputation.

[†] Inadequate foot care in the absence of any other red or amber traffic lights is not a major risk factor for severe foot problems.

factor and a precipitating factor are required to bring about the initial problem, most often an ulcer, leading to an amputation. Half of all amputations in people with diabetes are caused by a risk factor or precipitating factor that could have been changed, and the goal of diabetes foot care is to help prevent these amputations.

Foot problem risk factors

The podiatric ABCS of foot risk are:³

- A – Anaesthesia, as evidenced by peripheral neuropathy
- B – poor Blood supply, as evidenced by peripheral vascular disease
- C – inadequate Care, both of the feet

and regarding suitability of footwear

- S – abnormal foot Structure, which, with trauma, can lead to loss of skin integrity.

The 'traffic light' guide to foot risk factor assessment and appropriate patient responses to red, amber and green signals is outlined in Table 1. This guide is consistent with the NHMRC Guidelines, *National Evidence-Based Guideline on Prevention, Identification and Management of Foot Complications in Diabetes*, but is much simpler to apply in routine diabetes care.¹

Usually there is more than one amber light when a foot problem occurs, and the common risk factors for foot ulcers that

may lead to amputation are neuropathy, peripheral vascular disease and abnormal foot structure, or A, B and S, respectively, of the podiatric ABCS. Inadequate foot care is a potentially preventable factor in half of amputations.

The foot problem risk factors are common in people with diabetes: in Australia, 13% of those with diabetes have clinically significant neuropathy and 14% have peripheral vascular disease, either or both greatly increasing foot risk.¹ As noted, inadequate care contributes to half of amputations and abnormal foot structure is on the list of factors contributing to foot problems.

Foot problem precipitators

Foot problems are precipitated in people at risk who are exposed to physical, chemical or thermal trauma. The following case histories illustrate the typical problems that can lead to an amputation.

Phillippa

Foot risk factors: A, C and S (peripheral neuropathy, inadequate care and abnormal foot structure).

Precipitating factor: physical trauma.

'It all started on Tuesday when I wore my new shoes on a tour of the botanic gardens. I noted blisters on my bunions in both feet that night but on Thursday my left foot was red and swollen and there was pus coming from a new sore on the sole. I got a fever on Saturday and my doctor sent me to hospital.'

Cara

Foot risk factor: B (peripheral vascular disease).

Precipitating factor: chemical trauma.

'I didn't realise what the corn cure would do. My friend uses it quite often without any problems and it works quite well with her corns. It worked too well for me – the corn came off but the big toe turned white, cold and dead and then the area of whiteness moved up my foot. Later the whole front of the foot was dead and black and they cut it off.'

Thelma

Foot risk factor: A (peripheral neuropathy).

Precipitating factor: thermal trauma.

'I checked the temperature of the bath water with my hand before I got in, but when I sat down in the bath it was boiling hot. I jumped out, but I had terrible scalds on my feet and lower legs.'

Discussion of cases

Inadequate care contributed to the problem in all three of the described cases.

- Phillippa did not realise that new shoes should be broken in before they are worn for a long period of time. Also, she should have known how to choose shoes that would protect her feet rather than putting them at risk.

TABLE 2. RISK FACTORS FOR DIABETES COMPLICATIONS AND MANAGEMENT GOALS: THE ABCS OF DIABETES CARE²

Complication risk factor	Diabetes care goal	Target
Hyperglycaemia	A – glycosylated haemoglobin (A _{1c}) level	< 7.0% (< 53 mmol/mol)
Hypertension	B – systolic blood pressure	< 130 mmHg
Dyslipidaemia	C – LDL-cholesterol level	< 2.5 mmol/L
Smoking	s – quit smoking	0

- Cara did not realise that over-the-counter corn remedies are dangerous, whether or not the user has diabetes but especially for her. Because of her peripheral vascular disease, her blood supply, which might have been adequate to maintain skin integrity, was insufficient to allow healing after the corn cure damaged her skin (both the corn and, possibly, the surrounding normal skin). Cara's PVD also reduced her protection against, and response to, any infection that might follow.
- Thelma clearly did not realise that the neuropathy that was affecting her legs was also affecting her hands. She was already aware that she could not sense temperature in her feet but did not realise she could not feel how hot the water was with her hand.

IMPACT OF AMPUTATION

People who have had an amputation are affected in many ways, including the following:

- abnormal foot biomechanics and weight-bearing
- decreased mobility and stability (falls, inactivity and weight gain)
- psychological discomfort (depression, impaired body image, low self-esteem)
- withdrawal and isolation
- decreased general quality of life
- further amputation.

The medical complication risk factors of diabetes (hyperglycaemia, hypertension,

dyslipidaemia and smoking) have more effect with time, as do the other complication risk factors of age and duration of diabetes.² Complications such as peripheral neuropathy and vascular disease generally progress. However, better control of diabetes risk factors through a major review of diabetes management can slow this progression.

Increased foot risk

Having a diabetes-related lower limb amputation increases a person's risk of further complications related to foot structure in the same leg and also the other leg. In fact, half of amputations are followed by a further amputation of the same or other leg within five years.⁴ The risk is increased in both limbs because of the maldistribution of load on the weight-bearing surface of the limb with a below-ankle amputation (50% of amputations) and the extra load on the other foot in above-knee and below-knee amputations (the other 50%). The risk of a further amputation, and also the effect on gait and mobility, increases as the level of the original amputation increases from the fifth to the first toe, through the foot and to below the knee.⁴

Half of foot ulcers are potentially preventable with appropriate self and professional care. After an amputation, extra care will be needed because neuropathy and vascular disease are likely to get worse. The care provided by the patient and/or carer and their professional support system was

not adequate before the amputation, and it is unlikely the extra care required afterwards will be able to be provided. Hence, the patient will now require a higher level of podiatric and other professional care.

Increased mortality

The five-year mortality rate after an amputation is 40 to 80%, and is predominantly due to cardiovascular causes.⁵ An amputation adds the complication risk factors of physical incapacity and psychological, social and economic problems. The impact of these further risk factors is considerable. For example, the psychosocial issues of depression and the various losses after an amputation can set up a 'vicious cycle' with diabetes control and care – each making the other worse and making effective management more difficult.⁶

People with an amputation may also have significant physical limitations in their engagement with their usual routine activities, reluctance to resume previous social interactions and financial restrictions. Social isolation and lower socioeconomic status add other mortality risk factors to the medical factors.

STOPPING THE NEXT DIABETES DISASTER

Although it may not be clear which of the contributors to excess mortality in people with diabetes-related amputations are the most important, it is clear which are modifiable. These are listed below, with mention of how they may be modified.

- The medical complication risk factors hyperglycaemia, hypertension, dyslipidaemia and smoking, which may be modified by more intensive medical and self-care (Table 2).²
- The limitations of physical capacity, which may be modified by appropriate rehabilitation and provision of prostheses, orthotics and footwear.
- The psychosocial problems associated with the amputation, which may be modified by cognitive behavioural therapy, psychological counselling and antidepressant medication.

Often it is not clear which of the foot problem risk factors (the ABCS – peripheral neuropathy, peripheral vascular disease, inadequate foot care and abnormal foot structure) are the most important contributors to further risk of amputation, but all four can be addressed. Patient information leaflets about preventing and managing foot complications have been prepared by a consortium of specialist societies involved in diabetes care and are available at the Baker IDI Heart and Diabetes Institute website (<http://www.bakeridi.edu.au/Page.aspx?ID=728>).

Regarding further amputation and increased mortality, the major risk is that the patient will 'fall between the cracks' of the healthcare system and not be given the necessary extra medical care rehabilitation and psychosocial support, and subsequently suffer a potentially preventable diabetes disaster. After hospital discharge and the fitting of a prosthesis or orthotic, the GP may be the only health professional who remains involved with the patient and aware of the need for more intensive multidisciplinary monitoring and care. The full multidisciplinary team of specialist medical, nursing and allied health professionals may need to be involved in the early stages of rehabilitation, and several, particularly the podiatric professionals, should remain involved at regular intervals thereafter. The GP is also in a position to co-ordinate this necessary extra care and prevent a diabetes disaster.

CONCLUSION

In Australia, a person with diabetes has a one in six lifetime risk of a having a foot ulcer and an annual risk of about 1% of leg amputation. Foot ulcers and amputations usually result from a combination of foot risk factors (A – anaesthesia; B – blood supply; C – foot care; S – foot structure) and precipitating factors (physical, thermal and chemical trauma). Half of amputations are preventable if the foot risk factors are identified and appropriate intervention occurs.

After an amputation, there is a 50%

risk of further amputation in the same or the other leg and a 40 to 80% five-year mortality rate. An amputation should change the game for general practice healthcare of people with diabetes. Active multidisciplinary intervention should be arranged for the medical complication risk factors, the foot risk factors, psychosocial support and physical rehabilitation. **MT**

REFERENCES

1. Baker IDI Heart and Diabetes Institute, The George Institute for Global Health, Adelaide Health Technology Assessment. National evidence-based guideline on prevention, identification and management of foot complications in diabetes (part of the guidelines on management of type 2 diabetes). Canberra: Commonwealth of Australia; 2011. Available online at: <http://t2dgr.bakeridi.edu.au> (accessed May 2013).
2. Harris P, Mann L, Phillips PJ, Webster C. Diabetes management in general practice. Guidelines for type 2 diabetes. 18th ed. 2012/13. Canberra: Diabetes Australia; 2012. Available online at: <http://www.diabetesaustralia.com.au/en/For-Health-Professionals/Diabetes-National-Guidelines/#Diabetes-Management-in-General-Practice> (accessed May 2013).
3. Phillips P, Evans A. The ABCS of foot care in diabetes: assessing the risk factors. *Med Today* 2008; 9(11): 57-61.
4. Lawrence S, Wraight P, Campbell D, Colman P. Evidence-based guidelines for the inpatient management of acute diabetes-related foot complications. Melbourne: Royal Melbourne Hospital; 2004.
5. Moulik PA, Mtonga R, Gill GV. Amputation and mortality in new-onset diabetic foot ulcers stratified by aetiology. *Diabetes Care* 2003; 26: 491-494.
6. Goldney RD, Phillips PJ, Fisher LJ, Wilson DW. Diabetes, depression and quality of life. *Diabetes Care* 2004; 27: 1066-1070.

COMPETING INTERESTS: Dr Phillips has received research and travel grants, acted on advisory boards and been involved with clinical trials and seminars sponsored by a range of pharmaceutical companies. He does not think these associations have influenced the content of this article. Dr Evans has received various research grants but does not think these have influenced the content of this article.