Helen's high arch

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Patients with diabetes who have both high arched feet and peripheral neuropathy are at increased risk of foot ulcers. Here are some issues to consider in managing such patients.

Case history

Helen is 67 years old and has a 14-year history of type 2 diabetes that generally is well managed. She has normal foot pulses, dry but healthy skin, and clinical evidence of peripheral neuropathy with both vibration and pressure perceptions absent in the forefoot and mid foot and then reduced to the level just above the ankles.

Helen tries to walk for exercise to help blood glucose and weight control, but she often feels unstable on her feet and previously sprained both ankles when she used to play tennis. Her shoes are a slip-on, court style that show very worn down lateral heels and pressure 'bumps' over the toes in the shoe upper. She has a thick callus adjacent to the first metatarsal heads on both feet.

Helen says the weight bearing areas of the feet have shown callus build up in these regions for many years, but it is only in the last week that she noticed some blood on her right stocking and made an appointment to see you. She has an ulcer on her right foot surrounded by callus (Figure 1).

Figure 1. The ulcer and callus on Helen's foot.

Questions to consider

- Why has Helen developed this ulcer?
- How should the ulcer be managed?
- How can you assess Helen's foot structure and footwear?
- How can a recurrent ulcer be prevented?

Why Helen has developed this ulcer

The main reason why Helen has developed this ulcer is her neuropathy. Damage to the sensory nerves has led to loss

Table 1. Helen's foot health and action needed

Risk factors for ulcers	Helen's right foot	Action needed for Helen
Vascular	Healthy	General care
Neurological	Non-sensate	Education on injury risk
Self-care	Good	Daily visual checks of feet
Foot structure	Pressure areas	Use of orthotics and appropriate footwear that complements her foot type – probably an extra depth style of shoe to accommodate her high arch
Past ulcer	Newly developed foot ulcer	Debridement, dressing, off-loading of pressure and watching for infection

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of sensation and lack of pain has allowed her to tolerate damage that led first to her callus and then to the ulcer.

Damage to the motor nerves has led to muscle atrophy and thus to accentuation of the foot arch and clawing of her toes. The loss of intrinsic muscle stabilising of the metatarsophalangeal joints means the extensor pull is effectively unopposed and hence the toes retract (bearing less weight) to expose the metatarsal heads to peak forces. The abnormal foot structure has altered the normal distribution of pressure and overloaded her metatarsal heads, producing areas of callus and then the ulcer.

Helen's neuromuscular changes are consistent with her longstanding diabetes and neuropathy. More severe neuromuscular disturbance should prompt systematic review seeking some underlying neuromuscular disease such as Charcot-Marie-Tooth disease.

Damage to the autonomic nerves has led to loss of sweating and her dry skin. Fortunately, Helen has taken good care of her skin with moisturiser and has not developed any of the cracking often associated with dry skin. As shown in Table 1, Helen now has three of the five major risk factors for foot ulcers.[1] On the positive side, Helen has good circulation and takes good care of her feet. With appropriate management, the ulcer should heal.

Managing Helen's ulcer

'It's not what you put on an ulcer that helps; it's what you take off that's important.' The key point is: take off any debris and take off any pressure.[2-4] Keep the ulcer clean, moist and as undisturbed as possible (Figure 2). If the blood supply is adequate, the ulcer will heal. Removing any debris or pus cleans the ulcer, and removing the callus takes away part of the pressure that would otherwise damage the healing ulcer and retard or prevent healing.

A podiatrist could further reduce pressure loads by adding an orthotic device to Helen's shoes that will more evenly distribute the load, reducing pressure on the first metatarsal head ulcer and the callused area of the forefoot.

Reducing the pressure will reduce the tendency to callus formation in the long term. However, any callus that recurs should be removed and the suitability of orthotics reviewed regularly.

Calluses and corns are indicators of excess loads on the area and may also point to neuropathy, allowing the person to tolerate the damage that leads to callus or a corn and then to an ulcer.

Should the patient's ulcer not show obvious healing, it is recommended that he or she be referred to a diabetes foot clinic for assessment and management by a multidisciplinary team specialising in more complicated foot ulcerations.

Assessing Helen's foot structure and footwear

Look at Helen's feet and gait while she is sitting, standing and walking, first

Figure 2. Immediate ulcer care should include a moist wound dressing to cover the ulcer and a deflective pad to off load pressure.

Table 2. What to look for at the foot structure check up

Factors	Feet	Footwear	Gait
Nonweight-bearing factors	• Plantar calluses • Dorsal pressure areas • Arch shape	• Shape • Sole	Not applicable
Weight-bearing factors	• Normal • Flat: rolled in • High arch: rolled out	• Do the feet lean in or out of shoes? • Are there pressure areas over toe regions of the shoes?	• When barefooted, do the feet roll in or out, or stay straight? • Do shoes change the barefoot gait pattern? Is this better or worse?

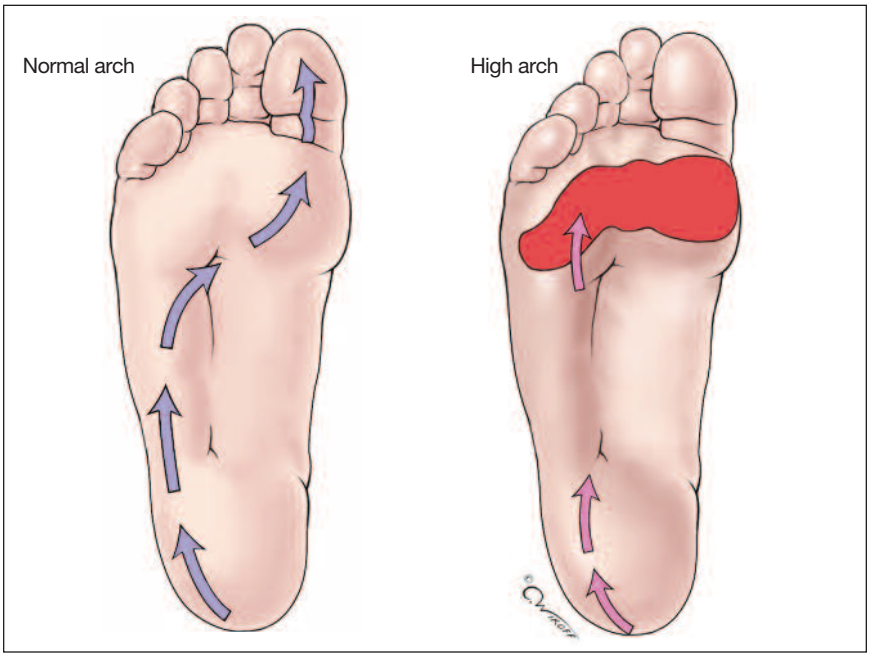

Figure 3. Left. The normal force line along the weight bearing aspect of the foot during gauge. Right. A high arch makes the foot roll out as the person 'pushes off' from the lateral side of the forefoot rather than the medial side.

without and then with the footwear that she uses every day (Table 2).[5]

Helen has a high arch. This leads to abnormal biomechanics and foot loading when she walks (Figure 3). The excess load is reflected in the pattern of wear of her shoes and the distribution of callus on her feet. As she walks, the high arch makes her foot roll out as she 'pushes off' from the lateral side of her forefoot rather than the medial side.

Do Helen's foot and gait look better, no different or worse when she is wearing shoes? Appropriate footwear should largely or completely compensate for the abnormal structure and lead to a more normal standing posture and walking gait.

Preventing ulcer recurrence

Helen already takes reasonable care of her feet but could probably decrease skin dryness by:

- reducing factors causing dryness, such as soap and exposure to water (especially hot water) and the air
- increasing the moisturiser schedule, such as the frequency and/or the oil content of the product used (for example, switching from a lotion to a cream).

Helen's footwear is obviously not ideal since she developed the ulcer in the first place. She should wear shoes to accommodate both her feet and orthotic insoles. Helen's toes are retracted at the metatarsophalangeal joints, which means that extra depth footwear is required to avoid pressure over the dorsum of the toes. Because she has neuropathy and has lost her sensation of pain, she may not feel pressure that is damaging her feet and may not take action to reduce that pressure.

A podiatrist can assess Helen's foot function and address this with a combination of appropriate footwear selection and orthotics to support and cushion her feet. It is likely that Helen will need specific footwear, although some athletic footwear can often be adapted.

Should further callus develop, it should be removed by Helen (for example, using a pumice stone after a shower), her general practitioner or her podiatrist.

A stable shoe will support the foot as it loads, yet allow for adaptation to different surfaces and while moving and turning. Flexibility across the forefoot is important so the foot can push forward. The lacing technique also needs to be addressed to ensure the best fit and reduce the chance of friction, which can cause blistering or ulceration. If an orthotic is needed, the shoe should be deep enough to incorporate this without compromising foot protection and foot function. The upper should allow for cooling by airflow evaporation.

An added bonus for Helen if she wears the appropriate footwear will be improved stability while standing and walking, which is important since she is in an age group in which falls become more common and can cause a fractured wrist or hip. MT

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