A multidisciplinary team approach to the treatment of osteomyelitis

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Article points

1. Diabetic foot infections, including infected foot ulcers, osteomyelitis and gangrene are a major cause for admissions for people with diabetes.
2. Diabetic foot complications have a significant financial impact on the NHS.
3. NICE recommends a multidisciplinary team approach to manage diabetic foot complications.

Key words

- Amputation
- Multidisciplinary team approach
- Osteomyelitis

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The following case report will focus on the multidisciplinary care team of a patient with diabetes who was diagnosed with osteomyelitis of the foot. His treatment is documented from the point of referral to primary care and discharge to secondary care and his journey along the care pathway. Emphasis will be placed on the benefit of an integrated approach to the care of the diabetic foot.

Diabetic foot infections, including infected foot ulcers, osteomyelitis and gangrene, are a major cause of hospital admissions for people with diabetes. Every year in the UK, approximately 5000 people undergo a leg, foot or toe amputation. This equates to 100 per week. Since 2006, the number of people diagnosed with diabetes in England increased from 1.9 to 2.5 million. By 2025, it is estimated that five million people will have diabetes, the majority of which will be type 2 (Diabetes UK, 2012). With an increase in the number of people affected by diabetes, and an ageing population, there is an increasing incidence of diabetic foot complications. Diabetic foot problems are the primary cause of non-traumatic lower limb amputations.

Diabetic foot complications have a significant financial impact on the NHS in terms of outpatient costs, increased bed occupancy, and prolonged hospital admissions. Any delay in diagnosis and appropriate management can result in an increase in mortality, morbidity and amputation rates, not to mention a detrimental impact on quality of life (SIGN, 2010; NICE, 2011).

The NICE guideline recommended a specific care pathway for all diabetic foot problems that require hospital admission. At the forefront of the guideline is the necessity for a multidisciplinary foot team (MDT) to manage this pathway; a team that includes a diabetologist, a surgeon with expertise in diabetic foot care, a diabetes nurse specialist, a podiatrist, and a tissue viability nurse.

The following case report will focus on the MDT care of one person with diabetes who was diagnosed with osteomyelitis of the foot. It will document his treatment from the point of referral to primary care and discharge to secondary care and his journey along the care pathway. Particular reference will be made to the benefit of an integrated approach to the care of the diabetic foot.

Patient history

Mr F, who is 65 years old with type 2 diabetes, initially presented to the A&E department of his local hospital on 20 July 2010 for the assessment and treatment of a neuropathic ulcer to his left fourth toe. The foot was X-rayed (*Figure 1*) and he was discharged home on oral flucloxacillin, metronidazole, and amoxicillin. His C-reactive protein (CRP) was 108 and he was not referred to podiatry.

Figure 1. X-rays taken in A&E, July 2010.

On 5 August, Mr F presented to a community podiatry clinic for treatment of the same toe following a GP referral. His foot was swollen and the wound malodorous, but he did not report any symptoms of systemic illness. The ulcer to the lateral proximal interphalangeal joint (PIPJ) was sloughy and bone was easily palpated from the base of the wound. Triple therapy was requested via the patient's GP (flucloxacillin 1 g QDS, sodium fusidate 500 mg TDS and metronidazole 400 mg) and the wound was dressed with Iodosorb® (Smith & Nephew) and Biatain® (Coloplast) foam. In line with local policy, the patient was immediately referred to the outpatient high-risk foot clinic at his local hospital.

Mr F's medical history included hypertension and hypercholesterolemia. His most recent HbA_{1c} was 60 mmol/mol (7.6%) on 6 August 2010. The aetiology of the ulcer was unclear, but Mr F reported that his GP and practice nurse had been aware of the issue for several weeks and it is possible that it originated as a blister.

Figures 2. Ulcer on the fourth left toe.

Clinical examination

Clinical examination of Mr F in the high risk foot clinic revealed peripheral neuropathy of the foot, determined by an inability to detect a 10 g monofilament. Perfusion of the lower limb and foot was discovered to be sound, with palpable pedal pulses, biphasic with the handheld Doppler. An ankle brachial pressure index of 1.5 was calculated, indicating a degree of arterial calcification; a common finding in people with diabetes (Edmonds et al, 1982).

Figure 3. Destruction of the head of the fourth and the proximal and middle phalanx.

A pole test (Donnelly et al, 2000) was also performed to determine further the degree of perfusion to the lower limb. Strong biphasic pedal sounds were still audible at a height in excess of 80 cm with no blanching of the skin, and no dampening of the sounds. Digital pulses remained audible throughout the test. The limitation of this test was the restriction encountered when the patient tried to elevate his leg.

The ulcer on the toe was deep and probing to bone (*Figures 2*). Manipulation of the toe indicated complete destruction of the joint (PIPJ).

Dorsiplantar and lateral X-ray views showed the degree of destruction (*Figure 3*), revealing further destruction of the head of the fourth and the proximal and middle phalanx. The second and third metatarsal heads were also more osteopenic, with a prominent "pencil-in-cup" type deformity.

Figures 4. Amputation of the fourth toe (a) and metatarsal (b) insertion of gentamicin beads.

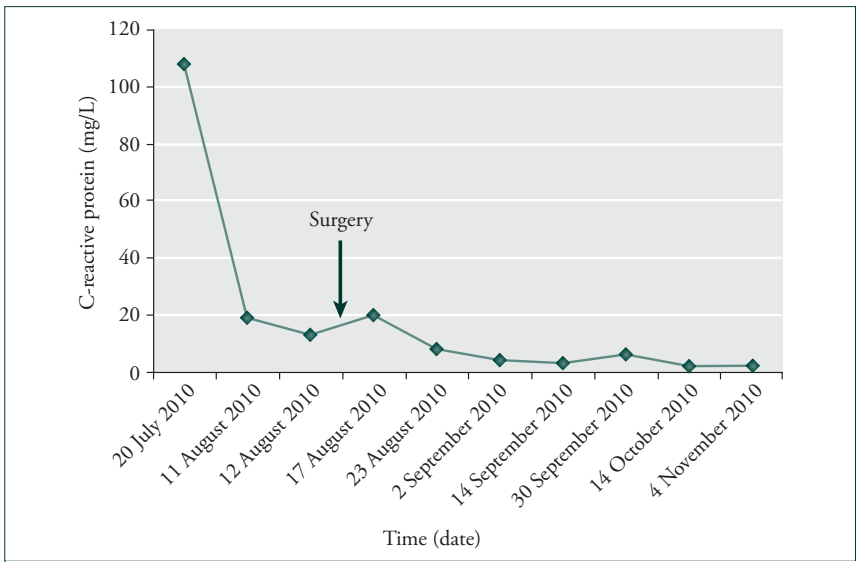

Figure 5. Mr F's C-reactive protein results between July and November 2010.

An MRI scan was requested. This revealed bony destruction affecting the head of the fourth left metatarsal and the adjacent portion of the proximal phalanx of the left fourth toe consistent with osteomyelitis. Additionally, there is involvement (to a lesser extent) of the heads of the second and third metatarsal and their adjacent inter-metatarsal bursae. Abnormal fluid collection is very near the skin surface and may fistulise.

The clinical decision was made to admit Mr F on 10 August for intravenous (IV) therapy based on a grading of three on the PEDIS scale (Schaper, 2004; Capobianco and Stapleton, 2010). Three days after his admission, Mr F underwent an amputation of his fourth toe and about half of the fourth metatarsal (*Figure 4a*). This was performed by the consultant podiatrist and the specialist foot team and was carried out under a local anaesthetic (ankle block). Gentamicin beads (Septopal®; Biomet) and gentamicin collagen (Septocoll E®; Biomet) fleece were applied to the surgical wound to establish drainage via partial closure, remove the focal point of infection, and gain control of the remaining infection (*Figure 4b*). Gentamicin, when applied locally as opposed to systemically, permits a greater concentration of the antibiotic at the site of action. Serum concentrations are significantly lower, and so too are adverse side-effects. Bone samples were sent to microbiology for analysis and produced moderate growth of mixed anaerobes, sensitive to metronidazole.

Mr F was discharged four days later on oral antibiotics – rifampicin 600 mg twice a day, metronidazole 400 mg three times a day, and flucloxacillin 1 g four times a day – based on Trust antibiotic guidelines and wearing an OrthoWedge™ (DARCO) shoe to offload the forefoot. A referral was made to the local district nursing service for dressing changes to be carried out at home every two days.

As discussed previously, initial blood samples taken in A&E revealed a CRP of 108. From the point of assessment with the podiatry team, Mr F's CRP results can be seen in *Figure 5*.

Liver function, urea and electrolytes, and full blood counts were tested every two weeks and remained within normal limits for the duration of this case. Blood monitoring was used as an adjunct to clinical signs of improvement and were beneficial to ascertain any detrimental toxic effects

of his antibiotic therapy. The spike in CRP noted on 17 August corresponds to post surgery.

Mr F attended weekly appointments at the high risk foot clinic for a collaborative review with the consultant podiatrist, microbiologist and diabetologist/acute medicine consultant. He remained on the oral antibiotics for a total of three months. The decision was made to progress conservatively and remove only the toe and part of the metatarsal as the primary aim was to preserve the forefoot if possible. Mr F also expressed his desire not to have further surgery and, as the infection was settling, this was determined to be the most appropriate course of action.

Mr F was involved in the decision-making progress from day one. He was aware that he may require further surgery (forefoot amputation). The surgery was staged so that if further procedures were needed, he would have a good plantar flap. The foot progressed well and surgery was not necessary.

The gentamicin beads were gradually removed from the surgical wound between weeks four and six, revealing a clean wound bed. Staged removal of the beads allowed for wound healing from the base. This wound bed was initially dressed with Aquacel® (ConvaTec) and Biatain foam.

At 8 weeks, Mr F transferred from the OrthoWedge to a flat DARCO Original MedSurg™ shoe (DARCO). Reduced swelling was continually observed in the foot, but to aid in this further a referral was made to the lower limb service for measurement of a compression garment. Mr F was also seen by the orthotist for bespoke footwear and accommodative insoles. As a precaution and preventative measure, Mr F was referred for a vascular review with the collaborative vascular service at a neighbouring trust.

A second MRI at week eight revealed a reduction in bone oedema. The surgical site was fully healed by week 10 and Mr F was transferred to the community integrated podiatry service for ongoing care.

Conclusion

At the time of writing, Mr F remains healed (*Figure 6*) and he has not developed any subsequent complications related to the surgery. He attends community appointments every 6 weeks for monitoring and his prognosis looks positive. His most recent HbA_{1c} was 43 mmol/mol (6.1%).

Mr F was interviewed recently and stated that he was "very happy" with the outcome of the surgery. When asked if he was scared or anxious at any point he did recall that initially he was worried that losing a toe might mean "he would not be able to walk". He was happy to report that this was not the case and he felt involved with the decision-making during this period of care. He was also pleased to have had the amputation under a local anaesthetic as this allowed the surgical team to talk to him during the procedure, which helped him to feel less anxious.

This case illustrates the benefit to the patient of an integrated team approach to diabetic foot care. Close ties between the podiatrists in primary and secondary care, the specialist foot team, microbiology, and radiology facilitated an efficient pathway for Mr F that resulted in reduced surgery, with the loss of a toe, rather than his whole forefoot. Had these ties not been in place, the outcome may well have been different.

Another factor that was pivotal to the success of this case was patient involvement from day one. At every point on his treatment journey, Mr F was advised of his options and given the opportunity to choose for himself. Informed consent empowered and motivated the patient, increasing his compliance.

It was clear from this case study that there is the constant need to ensure strong links exist between A&E and the foot protection team, to ensure rapid and accurate triaging of all urgent foot infections. Ongoing education and training is a requirement to ensure that this occurs. ■

Figure 6. Mr F's healed foot in October 2012.

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