



In-patient management of diabetic foot problems

All patients with diabetes admitted to hospital should have their shoes, socks, bandages and dressings removed to examine for:

Neuropathy	Ischemia
Ulceration	Inflammation and/or infection
Deformity	Charcot arthropathy

Any new and/or existing diabetic foot problems identified must be documented.

Urgent advice from an appropriate specialist must be obtained if there is strong suspicion of:

- Foot related systemic sepsis
- Deep seated foot infection
- Acute limb ischemia
- Acute Charcot arthropathy

During working hours, such urgent referrals should usually go through the diabetes outreach and the in-house vascular consultant teams for liaison with the hub vascular surgical team in Dudley and prioritised transfer as appropriate. During out of hours, such patients should have urgent review by the on-site surgical registrar who will liaise with the hub vascular specialist to agree and arrange transfer to Dudley as appropriate.

Patients with diabetic foot problems that don't fit into the urgent advice category must have access to the MDT foot team (Diabetes outreach and in-house vascular consultant) within 24h of the initial examination of the patient's feet.

Patients whose foot problem is the dominant clinical factor for inpatient care at New Cross and those patients that are repatriated from Dudley after their surgical intervention must be transferred to the consultant member of the MDT foot team for ongoing responsibility and continuing care. This will usually be on the diabetes ward.

The MDT foot team should

- Assess and treat the patient's diabetes and medical risk factors
- Regularly re-assess patient's response to initial management
- Determine need for specialist wound care, debridement, pressure off-loading and other surgical interventions
- Assess for pain and determine need for treatment and specialist pain services
- Assess vascular status and determine need for interventions
- Review treatment of any infection
- Assess and intervene to prevent deterioration and development of foot deformities
- Arrange discharge planning including appropriate follow up

The MDT foot team have the responsibility to

- Offer patients consistent, relevant information and clear explanations that support informed decision making
- Provide opportunities for patients to discuss issues and ask questions
- Provide a named contact to patients for information and to liaise between primary and specialist care

This will usually be provided verbally during their hospital stay and as copies of discharge letter at time of discharge with named Physician, Surgeon and Podiatry contacts.

Refer to the specialist protocols:

- **Infection Management and Antibiotic use in foot wounds and ulcers**
- **Wound Management & pressure relief**
- **Diagnosis and management of Acute Charcot neuro-arthropathy**

Diabetic Foot MDT referral

Critical Diabetic Foot (acute limb ischemia or limb/life threatening foot sepsis)	Non-critical/co-morbid Diabetic Foot (septic foot without immediate limb or life threat)	
<p>All areas including A&E</p> <p>On site Surgical SpR review</p> <p>Discussion with hub vascular consultant and transfer as appropriate</p> <p>Repatriation to Vascular ward or C25</p> <p>Post discharge follow up in diabetic foot clinic</p>	<p>Medical admissions</p> <p>Diabetes Outreach Consultant review</p> <p>Surgical opinion from in house vascular rota</p> <p>Priority transfer to Diabetes ward for onward care with continued liaison with in-house vascular Consultant</p> <p>Post discharge follow up diab foot ± vascular clinics</p>	<p>Surgical admissions</p> <p>On call surgical SpR review</p> <p>Inputs from in-house vascular & Diabetes Outreach Consultants</p> <p>Priority transfer to diabetes or vascular ward with continued liaison with in-house vascular consultant</p> <p>Post discharge follow up in diab foot ± vascular clinics</p>
<p>Non-admitted diabetic foot patients (all areas) – copy of discharge to rw-h-tr.wdcfootteam@nhs.net for timely f/up</p>		

Infection Management and Antibiotic Use in Diabetic Foot Wounds and Ulcers

Non-bacterial foot infection such as “Athletes Foot” should be treated promptly and effectively to avoid progression to more complex problems.

Suspected bacterial foot infection complicating foot ulcers and wounds should be under diabetes specialist review. Such cases should not be managed by other general medical teams or solely by surgical teams. Patients admitted to hospital with a foot related problem should similarly have the specialist diabetes foot MDT involvement as soon as possible and preferably within 24h of admission

Remember that clinical signs of inflammation may be less obvious in an ischaemic foot.

General approach to diabetic foot ulcer management

Specimens for culture

- Clinically uninfected ulcers rarely need to be cultured
- An acutely infected wound of mild or moderate severity in a person who has not recently been treated with antibiotic does not need to be routinely cultured
- Other wounds should almost always be cultured
- Superficial wound swabs for culture are rarely of help – enterococci, pseudomonas and anaerobes are frequently isolated from diabetic foot wounds, often representing colonisation rather than infection.
- Deep tissue culture by aspiration of purulent secretions or of abscess cavities, curettage of post-debridement wound base, punch biopsy and extruded or biopsied bones are the best specimens for culture.
- Blood cultures should be undertaken in systemically toxic patients.

Diagnosing and classifying infection

It is recommended that the presence and severity of infection be classified using the Infectious Disease Society of America classification system.

Grade 1	NO INFECTION	No purulence or signs of infection
Grade 2	MILD INFECTION	No systemic illness and evidence of either a. pus or b. two or more signs or symptoms of inflammation (erythema, warmth, pain, tenderness, induration) - any cellulitis <2cm around the wound and confined to skin or subcutaneous tissue
Grade 3	MODERATE INFECTION	No systemic infection and evidence of either a. Lymphatic streaking, deep tissue infection (involving subcutaneous tissue, fascia, tendon, bone) or abscess or b. Cellulitis >2cm
Grade 4	SEVERE INFECTION	Any infection with systemic toxicity

Presence of critical ischemia of the involved limb may make the infection severe

Diagnosing bone infection (Osteomyelitis)

If there is clinical suspicion of acute osteomyelitis, plain X-ray is the usual first investigation although serial X-rays may be required. Where the clinical suspicion remains high and plain X-ray is not diagnostic, carry out MRI or white cell scanning if MRI contraindicated. Probe to bone test is no longer acceptable to exclude or diagnose osteomyelitis.

Differentiating Osteomyelitis from Acute Charcot foot

Differentiating Acute Charcot and Osteomyelitis can be difficult and both conditions frequently occur simultaneously. Diagnosis is based on good history and examination and is assisted by obtaining supplementary investigations including X-ray, MRI, isotope bone and white cell scans. These patients should generally be under the remit of the specialist foot MDT.

General principles of antibiotic use

Prophylactic antibiotic use

There is no evidence for prophylactic antibiotics in clinically uninfected foot ulcers and antibiotics should therefore be used only in those with clinical signs of infection.

Therapeutic antibiotic use

Initial therapy is frequently empirical, based on the presumed pathogen and local epidemiological and susceptibility information.

Any previous microbiology results MUST be reviewed prior to prescribing empirical antibiotics.

This guidance is of value until microbiological investigations and clinical response shed further light on the nature of infection, where available.

Direct contact with local microbiologist may be necessary for advice on specialised use of these or other antibiotics.

Intravenous or oral

The choice of antibiotic and the route of delivery should reflect the severity of infection. Intravenous antibiotics are only required in patients with foot infection with:

- Systemic ill-health
- Deep or tracking infection
- Complicating necrosis or gangrene
- Those that have not improved or deteriorate on oral antibiotics.

When intravenous antibiotics are used, they should continue until the patient is not toxic, is able to take oral drugs and the foot lesion is definitely improving.

Duration of treatment

- Duration of treatment should similarly be adjusted according to the severity of infection and be guided by clinical improvement.
- In general, the duration of antibiotic should be kept to a minimum.

Allergies include skin rashes and anaphylaxis but do not include minor side-effects such as nausea. The nature of any antibiotic allergy needs to be fully elucidated and clearly documented.

Before prescribing any empirical antibiotic therapy the following questions must be addressed:

1. Has the patient received any recent antibiotic treatment (in the last 3 months), either from the GP or from the hospital? If so, which antibiotic(s) and duration?
2. Does the patient have any previous positive microbiology, either from samples sent by the GP or the hospital? If so, what are the results and the antibiotic sensitivity patterns?
3. Does the patient have any allergy to antibiotics, if so what is the nature of these? This **MUST** be clearly documented in the patient notes.
4. Has the patient had any recent hospital admissions for management of the diabetic foot? If so what treatment was given?
5. What is the patient's MRSA status?

The answers to the above questions will greatly influence **initial** choice of antibiotics therefore care must be taken to ensure that these questions are answered fully and clearly.

Antibiotic guidance -

Infection grade	MILD	MODERATE Out-patient treatment	SEVERE (In-patient)
Definition	No systemic infection & evidence of either a. pus or b. two or more inflammation signs or symptoms: any cellulitis <2cm around the wound and confined to skin or subcutaneous tissue	No systemic infection & evidence of either a. Lymphatic streaking, deep tissue infection (subcutaneous tissue, fascia, tendon, bone) or abscess or b. Cellulitis >2cm	Any infection with systemic toxicity Presence of critical ischemia of the involved limb may make the infection severe
Likely pathogen	Staph aureus or β haemolytic Strep.	Staph aureus or β haemolytic Strep. Anaerobes, Enterobacteriaceae & pseudomonas may need to be treated. Obligate anaerobes often associated with limb ischemia, gangrene, necrosis or wound odour	
Primary	PO Amoxicillin 500mg tds + Flucloxacillin 1g qds	PO co-amoxiclav 625mg tds	IV Piperacillin/tazobactam 4.5g tds
Alternative or Penicillin allergic	PO Doxycycline 100mg bd OR PO Clindamycin 600mg qds	PO clindamycin 600mg qds for 7days initially; if fails to respond or gram negatives likely, add PO Ciprofloxacin 500mg bd	IV Meropenem 1g tds (If severe allergy discuss with microbiologist on call) OR IV Clindamycin 600mg -1.2g qds plus IV Gentamycin 5mg/kg OR IV Vancomycin 1g bd plus PO ciprofloxacin 500mg bd plus IV Metronidazole 500 mg tds
MRSA	PO Trimethoprim 200mg bd or Doxycycline 100mg bd plus PO Rifampicin 300-600mg bd or Sodium fusidate 500mg tds	PO Trimethoprim 200mg bd or Doxycycline 100mg bd plus PO Rifampicin 300- 600mg bd or Sodium fusidate 500 mg tds OR Oral linezolid 600 mg bd (Maximum 14 days)	IV Piperacillin/tazobactam 4.5g tds plus IV Vancomycin 1g bd plus PO Rifampicin 600 bd or PO Sodium fusidate 500 tds OR IV Piperacillin/tazobactam 4.5g tds plus IV Daptomycin 4mg/kg od (monitor creatinine kinase) OR IV Piperacillin/tazobactam 4.5g tds plus oral or IV Linezolid 600 bd (14 days maximum)
Treatment duration	10 – 14 days and review	14 days and review. If osteomyelitis suspected discuss with microbiology & treat for at least 4-6weeks.	

Wound Management

- Debridement is thought to be essential for optimal healing rate, (Foster and Edmunds, 2000). Where significant arterial disease is absent, callous together with any necrotic, non-viable tissue, should be removed with a sterile scalpel using an aseptic technique.
- Sharp debridement of diabetic foot ulcers should only be undertaken by the specialist foot service, specialist practitioners and surgical teams
- Debridement may also be undertaken using larvae or appropriate dressings that promote debridement.
- In the ischemic foot it may not be appropriate to use a debriding dressing which hydrates necrotic tissue converting it into wet gangrene. The patient's vascular status must always be assessed prior to any debridement.
- Sharp debridement where there is an ischemic component should only be considered following discussion with specialist diabetes foot team, vascular team or Tissue Viability Service.

The rationale for debridement:

- Allows the true dimensions of an ulcer to be assessed
- Allows the drainage of exudates and removal of dead tissue rendering infection less likely.
- Enables a deep swab to be taken
- Encourages healing by restoring a chronic wound to an acute wound.

Wound Swabbing

Should be undertaken following debridement (Refer to antibiotic guidance)

Wound Cleansing

See Section 2 in main wound care policy

Dressing Selection

All dressings should provide the optimum wound healing environment and each stage of wound healing requires a specific type of dressing. Regular dressing change is crucial in the management of diabetic foot wounds due to the risk of rapid deterioration.

WOUND TYPE	AIM OF MANAGEMENT	DRESSING	OTHER CONSIDERATIONS
Eschar	Rehydrate eschar	Hydrogels	Dry gangrene must not be rehydrated. Consider high risk of wet wound to infection & deterioration where vascular supply is compromised.
Sloughy	Removal of debris from the wound bed	Hydrogels Hydrofibers	High risk of infection with wet wound. Moisture balance versus moist wound healing

Infected	Treat infection, manage exudates and odour	Honey Cadexameriodine Silver/ CharcoalPovidoneiodine	
Granulating	Create a moist environment, manage exudate	Alginates Foams	
Epithelialising	Create a moist environment	Foams	

Pressure Relief

Foot ulcers are often caused by pressure. This may be due to deformity, gait or inappropriate footwear. When dressing a wound, deflective padding, insoles, footwear and casts must be considered to redistribute pressure away from ulceration and so allow healing.

Caution must be taken with all non removable devices in the presence of sensory neuropathy and in the presence of active ulceration.

Consideration for formal offloading devices and footwear should be via the specialist diabetes service with appropriate liason with orthotics and Orthopaedic services.

- Semi-compression felt – this adhesive-backed padding may be cut to the shape of the foot to deflect pressure away from an area so as to encourage healing to take place.
- Insoles – to redistribute plantar pressures away from plantar ulcers and also provide suitable cushioning. They may need to be accommodated in bespoke shoes or extra-depth stock shoes.
- Temporary Footwear – may be required to accommodate dressings, insoles or deformity to offload pressure form ulcerated sites.
- Bespoke footwear – to accommodate deformity. Incorporated moulded insoles will remove pressure from vulnerable areas to allow ulcers to heal and reduce the risk of further ulceration occurring.
- Air Casts – lightweight removable plastic casts lined with air cells that are inflated with a hand bulb to a total contact fit, reducing plantar pressures by spreading weight bearing to a larger area. These casts limit joint mobility, have plasterzote (polyethylene foam) insoles which cushion and rocker bottom sole to reduce pressure through the plantar surface during gait.
- Total Contact Casting (Below-Knee Cast / Scotch Cast Boot) – fibreglass casts used to minimise peak plantar pressures to aid healing of plantar ulcers

Charcot foot in diabetes

Charcot neuro-arthropathy is a potentially severely disabling complication of Diabetes that can result in morbidity, mortality through decreased mobility, increased foot ulcer and amputation risk.

When to suspect?

It should be suspected in any patient with diabetes who complains of a hot and / or swollen foot. If suspected, such patients should be brought to the attention of the specialist Foot MDT for early review.

How to confirm diagnosis?

The diagnosis of Acute Charcot is largely clinical. A hot swollen foot with active inflammation and not as much discomfort is typically seen. Patients are expected to have underlying neuropathy and often have adequate (or even dynamic) peripheral circulation.

The aim of assessment is to exclude other common differential diagnoses including infection, non-Charcot acute arthritis (e.g. Gout), DVT etc. and to arrive at an effective short, intermediate and long term treatment plan. The objective is to prevent deformity or the complications of deformity including ulcer.

Baseline observations – full foot examination, record foot deformity by clinical photography, measure skin temperature bilaterally to document differential (≥ 2 degrees is abnormal).

Baseline investigations – to exclude infection and other causes of acute arthropathy

- Routine bloods including FBC, ESR, UE, CRP, HbA1c
- Plain foot and ankle x-ray – to document baseline; x-rays may be normal in the early stages of the Charcot process and may not become abnormal for weeks
- If plain X-ray suggestive and infection not considered a significant possibility, no further imaging may be needed to confirm diagnosis although serial X-rays recommended to monitor response.
- Where X-ray normal, confirm diagnosis with either MRI (preferred especially if concomitant ulcer) or isotope bone scan (if MRI contra-indicated/not tolerated or infection not considered likely). Increased uptake on bone scan indicates active pathology but does not differentiate between infection and arthropathy and may require further nuclear imaging (white cell labelled scan).

Infection reasonably excluded – infection is unlikely if the patient is afebrile, the WBC is normal and there is no foot ulceration or other obvious portal of entry of infection.

Unable to exclude infection – infection must not be missed, discuss with consultant radiologist to consider MRI scan or labelled WBC scan. If unable to confidently exclude infection discuss with consultant orthopaedic surgeon regarding the possibility of bone biopsy for culture.

How to manage if suspicion confirmed?

Immobilising the joint and offloading the foot is the mainstay of treatment during the acute phase of Charcot.

Most patients can be managed on partial weight bearing using Air Cast Walkers although compliance to its use has to be constantly reinforced. This is particularly useful for patients with concomitant ulcers.

Assessing activity / quiescence is very difficult but local foot temperature is the best clinical guide and must be documented at every review. Repeat imaging tests are rarely required

Treatment and care plans

- Immobilise the joint by casting
- If confirmed Charcot neuro-arthropathy – consider iv pamidronate 60 mg in 200ml n saline over 4 hours and repeat once at 72hours if no response clinically
- If osteomyelitis strongly suspected or confirmed, treat with intravenous then oral antibiotics for a minimum of 6 weeks.
- Review mobility, social and work situation: may need liaison with family, social services, physiotherapy and occupational therapy.
- It is usually necessary to have a multidisciplinary team review to ensure all aspects of the care plan are coordinated
- The MDT review conclusions must be documented and formally communicated to all members of the team and to primary care
- Follow up must be effectively organised with the specialist medical team and the high-risk foot service.