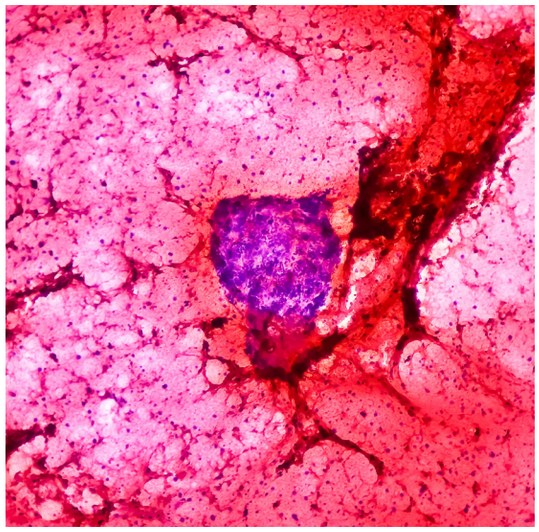
WOUNDS UK

Best Practice Statement

Osteomyelitis in pressure ulcers

2025



What is osteomyelitis?

Assessment and classification

Identification and diagnosis of osteomyelitis

Treatment of osteomyelitis in pressure ulcers

Recurrence and prevention

BEST PRACTICE STATEMENT: OSTEOMYELITIS IN PRESSURE ULCERS

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Foreword

A multidisciplinary group of experts met online in April 2025 to discuss management of osteomyelitis. It quickly became apparent that osteomyelitis in pressure ulcers (PUs) is a particularly challenging area, in which evidence and guidance are needed. There is currently a lack of both evidence and clinician knowledge and confidence in how to treat patients with osteomyelitis in PUs, in particular PUs that occur on the sacrum or other larger bony areas.

Within podiatry, there is a clear pathway for treating patients with osteomyelitis in PUs that occur on the foot (below the ankle). However, in PUs that occur above the ankle, current practice is less clear. Data clearly identify that the sacral area is the place where deep PUs are most commonly seen in practice; however, this is where there is the greatest lack of evidence.

This best practice document aims to fill this gap and provide much-needed guidance to all clinicians, with the ultimate aim of providing standardised optimal care to patients. Drawing on existing evidence and the experts' experience, this document will provide guidance on how to:

- Identify osteomyelitis in PUs above the ankle
- Diagnose osteomyelitis using testing methods available in local practice
- Assess and classify pressure damage and osteomyelitis, with a holistic assessment checklist
- Use a standardised pathway to provide effective treatment
- Change team mindsets to encourage optimal practice
- Improve patient experiences and outcomes.

The document also aims to highlight the importance of interdisciplinary and multidisciplinary team (MDT) working. Experience has shown that this is the key way to improve outcomes in this complex group of patients.

We hope this document will empower clinicians, raising awareness of this important area and providing the knowledge and confidence they need to deliver gold-standard care to patients.

Jacqui Fletcher, Chair

What is osteomyelitis?

Osteomyelitis is an inflammation of the bone that is usually the result of an infection. Healthy bones are generally resistant to infection when the bone and surrounding tissue are intact, but osteomyelitis can occur when bacteria invade the bone through the bloodstream, or through exposed bone in a nearby wound or fracture (Aiken et al, 2024).

Untreated osteomyelitis can progress and lead to serious complications, including permanent bone damage, the spread of infection to other bones, sepsis and, in severe cases, amputation (National Health Service [NHS], 2023). Furthermore, recurrence is common, and infections that persist for more than four weeks or reappear following initial recovery may be classified as chronic osteomyelitis (Khater et al, 2022).

There are multiple potential causes of osteomyelitis, such as:

- Trauma from open or closed fracture
- Orthopaedic surgery
- Sensory neuropathy associated with or without peripheral arterial disease (PAD), leading to ulceration at pressure points
- Presence of a foreign body to which bacteria can attach
- An open wound that has been chronic and open for an extended amount of time near a bony prominence, or a deep wound over a bony prominence (Aiken et al, 2024).

Osteomyelitis in pressure ulcers

PUs frequently develop over bony prominences, increasing the risk of underlying bone infection. Category 4 PUs are defined by exposed bone, tendon, or muscle, and are often colonised by bacteria, creating conditions conducive to infection and the development of osteomyelitis (Crespo et al, 2020). In severe PU cases, particularly Category 4 PUs, there is an increased risk of osteomyelitis.

In diabetes, osteomyelitis does not primarily result from impaired blood supply but from infection complicating ulceration, which is pre-disposed by sensory neuropathy. Compromised blood supply, when present, contributes to impaired wound healing and the spread of infection (International Working Group on the Diabetic Foot [IWGDF], 2023).

Patients with mobility issues (particularly those who are wheelchair users or bedbound) are at increased risk of pressure-related skin ulcerations, especially on the sacrum, buttock, hips and heel. These ulcers are prone to infection that can quickly spread to the underlying bone (National Library of Medicine [NLM], 2023).

Estimates of the scale of the issue vary widely: incidence of osteomyelitis in Category 4 PUs ranges from 14% to 86% (Crespo et al, 2020). From an economic viewpoint, there is already a significant financial burden associated with Category 4 PUs, which is significantly increased in those patients in which ulcers progress to infection of the underlying bone (Bodavula et al, 2015).

The impact on affected patients in terms of their wellbeing and quality of life is significant but also under-reported. Osteomyelitis can have catastrophic consequences for the patient, including delayed healing, extensive use of antibiotics, hospitalisation, amputation and increased risk of premature death (Linsley and Reel, 2021).

Evidence and practice

Although osteomyelitis is a common complication associated with pressure damage, few studies exist to guide the management of patients with PUs with possible underlying osteomyelitis. Clinicians report widely divergent diagnostic and treatment approaches (Kaka et al, 2019), with most of the reported practice not supported by the available evidence, which has been found to be limited and of low quality (Wong et al, 2018; Ferris, 2024).

WHAT IS OSTEOMYELITIS?

Most of the evidence relating to osteomyelitis is for the patient with a diabetic foot ulcer, where infection that may lead to osteomyelitis is a common complication, estimated to affect approximately 60% of foot ulcers (Berbudi et al, 2020).

It is recognised that early intervention in the foot is imperative, which is generally driven by podiatrists working within the MDT and, as such, there is a more efficient pathway for diagnosis and treatment when osteomyelitis occurs in ulceration below the ankle (Linsley and Reel, 2021).

Anecdotal evidence from practice shows that osteomyelitis is frequently seen in sacral PUs, but this is where there is a noted lack of evidence. Lessons learned from practice, informed by the approach taken in the foot, can help to inform more standardised care and improve patient outcomes.

Assessment and classification

All treatment should be underpinned by a full holistic assessment of the patient to inform clinical decision-making. In patients with PUs and osteomyelitis, it is important to assess the skin and the wound, and to classify both the pressure damage and the osteomyelitis.

See **Appendix 1** (page 18) for a pathway for assessment and management of osteomyelitis in patients with sacral PUs.

Holistic assessment

A thorough holistic assessment is essential when examining a patient with pressure damage and suspected osteomyelitis (Aiken et al, 2024). Holistic wound assessment considers the whole patient and should comprise at least the components of the generic wound assessment minimum data set (**Table 1**; Coleman et al, 2017).

Assessing the patient's overall health and wellbeing is also important as part of viewing the patient holistically, including psychosocial factors (World Union of Wound Healing Societies [WUWHS], 2020). Establishing the patient's medical history, particularly concerning the skin/wound is key. Recurring wounds and previous occurrence of osteomyelitis increases risk (The British Medical Journal [BMJ], 2021).

Table 1. Generic wound assessment minimum data set (adapted from Coleman et al, 2017; Wounds UK, 2018)

Domain	Core data set items
General health information	• Risk factors for delayed healing (systemic and local blood supply, susceptibility to infection, comorbidities, medication affecting wound healing, skin integrity, smoking, malnutrition) • Allergies and skin sensitivities • Impact of the wound on quality of life (physical, social and emotional)
Wound baseline information	• Number of wounds • Wound location • Wound type/classification • Wound duration • Treatment aim • Planned reassessment date
Wound assessment parameters	• Wound size (maximum length, width and depth) • Undermining/tunnelling • PU category • Wound bed tissue type • Wound bed tissue amount • Description of wound margins/edges • Colour and condition of surrounding skin • Whether the wound has healed
Wound symptoms	• Presence of wound pain • Wound pain frequency • Wound pain severity • Exudate amount • Exudate consistency/type/colour • Signs of systemic infection • Whether a wound swab has been taken
Specialists	• Investigation for osteomyelitis • Referrals

In patients with — or at risk of — pressure damage, holistic assessment should include offloading and prevention. Ideally this should include working with the MDT for at-risk patients, particularly those at long-term risk (e.g. patients with comorbidities or spinal injuries; wheelchair use, frailty or other mobility issues).

It should be noted that patient demographics may vary. Affected patients may be frail/elderly, but younger patients may also be affected.

Holistic assessment should trigger action where necessary, based on the patient's individual needs and wellbeing. For example, all patients should be offered smoking cessation support if they wish.

Wound assessment

The National Institute for Health and Care Excellence (NICE, 2024a) state that a PU should be diagnosed if a person with risk factors develops evidence of skin damage over a bony prominence, which is supported by the presence of any of the following:

- An area of non-blanchable erythema, which may present as colour changes or discolouration, particularly in people with dark skin tones
- Marked localised skin changes
- A wound of varying severity on an anatomical site that is known (or suspected) to have previously been exposed to significant unrelieved pressure.

Every wound assessment should follow a structured framework and, in the case of PUs, should be classified by a PU-specific grading system that takes account of the depth and severity of skin damage (see below; Atkin et al, 2019)

Assessing and classifying pressure ulcers

The National Wound Care Strategy Programme (NWCSP) for PUs states that skin assessment should be based on a combination of skin temperature, skin texture, patient reports of pain and discomfort as well as visual skin assessment; this is particularly important when considering skin of dark colour and tone (NWCSP, 2023).

The NWCSP also suggests that the following factors should be considered and documented as part of a comprehensive wound assessment:

- Full history, including any previous history of pressure ulceration
- Review of medication
- Pain and analgesia needs
- Psychosocial needs
- Possible infection
- Nutrition
- Record image(s) of ulcer(s) using digital imaging.

PUs should be categorised following local guidance (see **Table 2,** for example). According to guidance in England, a Category 4 PU automatically includes exposed bone, tendon, or muscle, meaning high risk of osteomyelitis.

Table 2. In England, PUs should be categorised using the following 4 categories (NWCSP, 2023)

Category 1. Pressure ulcer/ non- blanchable erythema	The ulcer appears as a defined area of persistent redness (erythema) in lightly pigmented skin tones, whereas in dark skin tones, the ulcer may appear with persistent red, blue or purple hues, without skin loss. The patient may report pain or discomfort over the area.
Category 2. Pressure ulcer	Pressure ulcer with abrasion, blister, partial-thickness skin loss involving epidermis and or dermis.
Category 3. Pressure ulcer	Pressure ulcer with full-thickness skin loss involving damage or necrosis of subcutaneous tissue. Undermining and tunnelling may occur, fascia, muscle, tendon, ligament, cartilage and or bone are not exposed.
Category 4. Pressure ulcer	Full-thickness skin and tissue loss with exposed or directly palpable fascia, muscle, tendon, ligament, cartilage and/or bone in the ulcer. There is an increased risk of osteomyelitis.

Assessing and classifying osteomyelitis
As well as identifying and diagnosing osteomyelitis (see page 9), it needs to be assessed on an ongoing basis and classified to guide treatment options.

In osteomyelitis, hosts (i.e. patients) are generally classified under the Cierny-Mader classification system (Cierny et al, 2003; BMJ, 2021). This includes three physiological classes of patients (A, B, C):

A: People with no comorbidities that compromise outcome; able to withstand surgery and antibiotic therapies
B: Those with comorbidities that directly reduce the likelihood of wound healing, reduce the efficacy of drug treatment, or increase the risks of surgery
C: People who are so severely compromised that treatment has an unacceptable risk-benefit ratio and, therefore, the treatment of their infection can be more harmful than the condition.

Further, there are four anatomical types (1 to 4) based on the degree of bone involvement:

1. Medullary and endosteal bone; mostly associated with haematogenous infection
2. Superficial osteomyelitis from contiguous focus infection; often arises in the base of a varicose ulcer, or from external trauma or a PU
3. Both medullary and cortical involvement; the osteomyelitis is limited to part of the circumference of the bone, leaving a healthy portion of the bone to maintain stability
4. Diffuse involvement of the entire circumference of the bone.

Treatment options will be guided by the individual patient factors and the assessment and classification.

Assessment checklist for use in practice
Make sure the following factors have been included as part of the assessment:

- Does the individual need guidance on offloading?
- Are smoking cessation services needed?
- Does the individual have a reasonably balanced and healthy diet? Does the patient have a diet high in protein? Is a dietician review needed?
- If the individual has diabetes, is it well controlled?
- Is a safeguarding referral needed?
- Depression and low mood are common in this patient group and can reduce compliance. If the patient is in hospital, do the general physician and/or mental health liaison team need to assess?

Identification and diagnosis of osteomyelitis

Accurate and timely diagnosis of osteomyelitis is imperative to initiate intervention more efficiently, enhance healing rates and prevent deterioration; however, this can prove challenging in clinical practice due to the lack of consensus and evidence around strict criteria to help inform diagnosis (Wong et al, 2018; Linsley and Reel, 2021; Ferris, 2024).

While diagnosing osteomyelitis ideally incorporates several of the testing methods outlined below, it is acknowledged that it can be challenging in practice to obtain testing and multidisciplinary referral and input. It has been reported that methods of diagnosing osteomyelitis in the presence of Category 4 (severe) PUs vary widely, particularly as practice is not generally supported by the available evidence, which is quite limited and of low quality (Wong et al, 2018; Kaka et al, 2019; Ferris, 2024).

Before diagnostic tests are requested, consider the individual's offloading capabilities, ability to withstand long-term antibiotics and their suitability for different diagnostic tests.

Diagnosing osteomyelitis

Diagnosing osteomyelitis can be challenging, as its signs and symptoms may be non-specific and overlap with those of other conditions commonly encountered in clinical practice, such as cellulitis and other complications. These signs and symptoms may include (Hofstee et al, 2020; BMJ, 2021):

- Fever/chills
- Lethargy and general malaise
- Pain (although this can be further complicated if the patient has a concurrent condition resulting in loss of sensation)
- Poor wound healing
- Difficulty walking or bearing weight; reduced range of movement
- Swelling at the site of infection
- Persistent/increased exudate from a wound and/or sinus tract.

Typical signs and symptoms may not always occur, so it is important to have a high index of suspicion in at-risk patients (BMJ, 2021). Deep ulcers should always raise suspicion of osteomyelitis if there is bone exposure or if the ulcer has been open for an extended time (several months or longer; Aiken et al, 2024). It is important to be aware that symptoms can vary for each patient, with some signs presenting more subtly (NLM, 2023).

Clinicians anecdotally believe the strongest clinical indicator of osteomyelitis in the presence of PUs is generally palpable or visible bone at the ulcer base, which should prompt further testing (Kaka et al, 2019). However, there is also debate as to how reliable the samples and sampling methods are at finding the pathogens histologically.

Probe-to-bone testing

The probe-to-bone (PTB) test is widely used as a clinical indicator of osteomyelitis in the feet of people with diabetes. The test involves inserting a sterile probe into the wound to determine whether bone can be contacted. However, evidence regarding the diagnostic accuracy and effectiveness of the PTB test remains inconclusive (IWGDF, 2019).

The majority of evidence for PTB testing has been found in patients with diabetic foot ulcers, as opposed to patients without diabetes or with wounds in other areas of the body. In the patient with a diabetic foot ulcer, PTB testing has been found to be inexpensive, accessible and relatively safe (International Wound Infection Institute [IWII], 2022).

There is no substantive evidence that PTB testing is a useful diagnostic tool in any area other than diabetic foot ulceration. However, the general rule with PTB testing is that it can be used to guide clinical suspicion: if the wound cannot be probed to bone, osteomyelitis is unlikely to be present; if it can be probed to bone, this should prompt high suspicion of osteomyelitis and consideration of antibiotic treatment.

IDENTIFICATION AND DIAGNOSIS OF OSTEOMYELITIS

To aid clarification of osteomyelitis diagnosis, further investigations should be considered, such as clean bone biopsy. However, it is important to be objective when considering a patient for a bone biopsy. This is an invasive procedure, which may not alter management for many patients (Ferris, 2024). It is important to note that osteomyelitis should always be suspected if there is any report of exposed bone, or if a sinus wound has increased exudate.

Imaging tests

If the bone is exposed or can be probed, there is a much higher risk of osteomyelitis being present, and imaging should be ordered to screen for bone abnormalities at the site of the wound (Aiken et al, 2024).

If bone is visible, an X-ray or magnetic resonance imaging (MRI) is rarely needed unless surgical intervention is required (see below). However, radiological imaging can be a useful diagnositic test, where the diagnosis of osteomyelitis is unclear as it can confirm or deny a diagnosis and may help assess if osteomyelitis is progressing. Imaging, such as X ray or MRI scanning, can be useful in certain clinical cases (Calvo-Wright et al, 2023).

Where osteomyelitis is suspected following a positive PTB test, X-rays should be considered as part of first-line diagnostic tools, where available. It is important to note that osteomyelitic changes to the bone will take time to be visible on an X-ray, so will not be accurate in a new or emerging bone infection. This underlines the importance of thorough and early wound assessment that does not rely solely on imaging (see page 6). Additionally, not all patients — particularly those with complex comorbidities and/or severe mobility issues — will be able to travel to hospitals or diagnostic centres for X-rays and may need different measures to be taken based on their individual circumstances and capacity.

In patients with significant comorbidities, it is important to take a pragmatic approach. Clinicians need to understand that imaging will only change management if a patient is septic or where surgical management is planned. The role outside this is limited, as it is unlikely to change management.

Blood tests

Best medical practice suggests that blood testing can be useful, particularly if the patient has a fever (BMJ, 2021). Where possible, a comprehensive set of blood tests, including a full blood count, C-reactive protein (CRP), renal and liver function tests, HbA1c and vitamin D, is recommended to establish the patient's baseline health status and provide a holistic overview of their overall health. Although they are not diagnostic tests for osteomyelitis, testing for liver and kidney function and CRP can help to identify barriers to healing or the need for further referral. Blood testing can also be used on an ongoing basis to monitor the patient's overall improvement (or identify deterioration).

Bone biopsy

A bone biopsy is a procedure where a needle or small surgical incision is used to obtain a small sample of bone tissue for examination and analysis. Bone biopsy is usually performed during the surgical debridement procedure (BMJ, 2021). Examination of bone biopsy specimens is considered the diagnostic gold standard in osteomyelitis in the presence of PUs (Chicco et al, 2020). However, taking a bone biopsy is invasive for the patient and will not always be possible in practice (Ferris, 2024). Furthermore, bone biopsy may be challenging due to lack of trained staff and resourcing.

Bone biopsy in osteomyelitis of PUs has previously been found to be a 'low-yield' procedure that plays only a minor role in diagnosis and treatment of osteomyelitis and very rarely altered antibiotic treatment (Mikus et al, 2013). Therefore, bone biopsy is recommended only in highly selected cases, such as poor response to standard therapy or incongruent clinical and radiologic findings (Mikus et al, 2013). Where clinically indicated, image-guided fine-needle aspiration may be preferred over an open bone biopsy, as it is less invasive and causes less disruption to the bone while allowing multiple specimens to be obtained (BMJ, 2021).

However, a systematic review found that no other diagnostic method (clinical, microbiological or radiological) was reliable in the diagnosis of pelvic osteomyelitis associated with PUs compared to bone biopsy histology (Chicco et al, 2020). Whether this is used is likely to depend on availability and practicality in practice.

Swabbing to guide treatment

There is some debate over the usefulness of swabbing being used in practice to guide treatment. Whether deep swab cultures taken at admission reliably identify pathogens compared to surgical bone specimens in hospitalised individuals with diabetic foot osteomyelitis and soft tissue infection is unclear (Manas et al, 2021). For swabbing, the Levine technique is recommended over the Z technique (Angel et al, 2011).

Given the growing importance of antimicrobial stewardship (AMS), particularly in the context of recurrent infections that may necessitate repeated courses of antibiotics, swabbing can be a valuable tool in clinical practice. Although collaboration with microbiology colleagues is ideal, this may not always be feasible. In accordance with local guidelines, initial swab results should ideally inform antibiotic selection to support appropriate prescribing (BMJ, 2021). Swabbing can facilitate targeted, more effective treatment and is generally a simple, non-invasive and cost-effective procedure (IWII, 2022).

If infection is evident and the patient requires urgent treatment, it is not recommended to wait for microbiology results before starting antibiotics, but the results may be useful to guide ongoing treatment. Clinical judgement should be used in accordance with local guidance.

Treatment of osteomyelitis in pressure ulcers

Any treatment of osteomyelitis in patients with PUs needs to be two-fold: addressing the cause of the pressure damage and addressing the infection associated with osteomyelitis. Early intervention is key to avoid worsening outcomes and aiming for a multidisciplinary approach is essential (Aiken et al, 2024).

It is also vital to take meaningful steps in understanding and addressing the psychology of individual patients and considering whether talking therapies or psychology input would be beneficial. Although this may not apply to all patients, many individuals with chronic osteomyelitis have complex medical and personal histories that may contribute to delayed wound healing and challenges in engaging with recommended treatment.

Goals of treatment

Before commencing any treatment plan, it is important to establish the goals of treatment in collaboration with the patient. In many cases, the primary aim will be to heal the wound, but this is not always possible and pragmatism may be necessary in practice. This also involves open and transparent communication between clinician and patient — as well as family, where appropriate — and managing expectations where necessary. The patient's priorities and preferences will be the most important guiding principle in decision-making, with care tailored to the individual.

The patient's individual priorities may include practical factors, such as achieving the most independence possible (e.g. in the case of spinal injury patients), carrying out daily living activities or getting back to work. If healing is not possible, the focus may be on preventing deterioration and preserving the patient's quality of life.

The patient's overall prognosis and comorbidities may mean that more active treatment is not possible or appropriate, so a palliative care pathway should be considered, with the patient's wishes and quality of life at the centre of all care (see **Box 1**).

Box 1. Palliative wound care

In frail or elderly patients with multiple comorbidities, active infection treatment or aiming for wound healing may not be in the patient's best interest. Anecdotal experience has highlighted the danger in starting the patient on treatment plans and antibiotic therapy that will not benefit the patient. In these cases, it may be better for the focus to be on symptom management and overall comfort.

This may result in difficult conversations with patients and their families to manage expectations; however, it is important to be as honest and transparent as possible, while focusing on the patient's wishes and quality of life.

Systemic antibiotic treatment

Systemic antibiotics are often prescribed in osteomyelitis. Any antibiotic use should be considered as part of the whole treatment programme tailored to the individual, rather than in isolation. As part of an AMS-based approach, use of repeated antibiotic courses should be minimised, so investigation may be needed.

There are growing concerns regarding antibiotic overuse, with evidence suggesting that patients often receive prolonged courses of antibiotic therapy beyond those supported by the available literature, highlighting the urgent need for further research in this area (Kaka et al, 2019).

Additionally, effective treatment can be disrupted by complications developing with systemic antibiotic use, including allergic reactions, antibiotic-resistant organisms, the risk of *Clostridium difficile* infection and possible organ toxicity. Poor vascular perfusion can also limit the availability of antimicrobial therapy to infected tissue in the foot wound (Chadwick et al, 2022).

A systematic literature review focused on osteomyelitis in sacral PUs stated that the goal of therapy should be local wound care and assessment for the potential of wound closure; if the wound can be closed and osteomyelitis is present, appropriate antibiotic therapy is reasonable (Wong et al, 2018).

Antibiotic treatment duration may be guided by the extent of bone involvement, with a 2-week course considered for more superficial osteomyelitis, as reported in much of the literature, and a 4–6-week course for cases involving the medullary bone. Extending antibiotic therapy beyond 6 weeks is not supported by current evidence (Wong et al, 2018).

Surgical debridement

Infection within the articular joint (e.g. the hip joint) is a serious complication. Where osteomyelitis predisposes to fracture, poor

blood supply to the femur should prompt consideration for an excision arthroplasty, where appropriate. Specialist advice should be sought on the need for surgical management (e.g. debridement or drainage of abscesses), in addition to antibiotic therapy (BMJ, 2021). In osteomyelitis, this may include both soft tissue and bone debridement.

In practice, generally the soft tissue around the bone is debrided and the bone is left intact. Removing detached pieces or fragments of bone may be necessary as part of the tissue debridement process, but this would not be considered bone debridement.

Bone debridement is not typically carried out, as it is difficult to perform successfully in practice. Ideally, necrotic bone should be removed but this can be challenging to identify and isolate.

If bone debridement is undertaken, this will need to be with specialist medical input: sharp debridement is a specialist skill that may not be available in practice, depending on staff training and availability.

Optimising health and wellbeing
To optimise healing, holistic factors need to be addressed that encompass the patient's general health and wellbeing. This includes nutrition, smoking cessation and optimising diabetic control. Patients should also be screened for low vitamin D, as this impacts on wound healing.

It is important to remember that these may be complex patients with multiple comorbidities that need to be addressed. The psychological impact also cannot be underestimated, with a potentially significant effect on an individual's daily life and wellbeing. Psychosocial factors — such as the patient's environment, mental health and support networks — should also be considered (WUWHS, 2020).

Repositioning and bed rest
It is important to consider how the patient originally developed a PU; addressing and offloading the source of pressure is central to management.

If stationary, the patient should be encouraged to change their position at least every 4/6 hours to avoid further damage; if they are unable to reposition themselves, they should be offered help to do so, using appropriate equipment if needed (NICE, 2024b).

Bed rest may be recommended as part of treatment in patients with PUs, but the potential benefits and risks need to be considered for the individual. International guidelines suggest bed rest as a component of the treatment strategy to manage PUs among wheelchair users, but there is no conclusive evidence to suggest that bed rest makes a difference to the healing of PUs (Moore et al, 2016).

See page 15 for further information on risk reduction.

Reconstruction for pressure sores
In patients fit enough for surgical intervention, reconstruction for pressure sores should be considered when conservative management has failed. Bowel diversion surgery may be an option when soiling is contributing to poor healing. Plastic surgery with flap coverage should be considered; unfortunately, the evidence to support this is still lacking (Norman et al, 2022).

In the UK, there is a strong argument that complex surgical cases should be managed in specialist centres (Ferguson et al, 2021). Unfortunately provision of services is not consistent across the country.

Local antibiotic treatment for osteomyelitis in pressure ulcers

Local antibiotic delivery

With increasing emphasis on AMS, local antibiotic treatment may be more appropriate in some patients than systemic treatment. Novel methods are now available that deliver antibiotics directly to the site of infection, as an adjunct therapy to systemic treatment. This comprises of a system whereby an antibiotic is mixed with calcium sulfate powder to form a paste to shape small beads. These can be placed in the wound following debridement; the antibiotic is then released at therapeutic concentrations to the site of infection (Chadwick et al, 2022).

In 2025, the first randomised controlled trial (RCT) in patients with diabetic foot osteomyelitis (DFO) showed that the use of antibiotic-impregnated calcium sulfate (STIMULAN®) beads is economically sustainable and has the potential of improving the prognosis of DFO (Monami et al, 2025).

A retrospective cohort study of 137 consecutive cases of osteomyelitis or significant soft tissue infection over 62 months treated all cases with surgical debridement and local antibiotic-loaded calcium sulfate. Across the 137 cases, 88.3% of infections resolved. Infection was eradicated in 22 patients without postoperative systemic antibiotics. About 82.5% of wounds healed, with an average healing time of 11.3 weeks.

As these were complex patients, healing time was significantly increased for the comorbidities of diabetes and PAD, and for those requiring prolonged systemic postoperative antibiotics. Conservative surgical debridement and implantation of local antibiotic-impregnated calcium sulfate was found to be safe and effective in managing complex foot infections, with the authors advocating early surgical intervention before deeper tissue involvement to help preserve lower limb structure and function (Morley et al, 2022).

Use of antibiotic-impregnated resorbable beads reduces PU recurrence: in a retrospective analysis of recurrent Category 4 PUs, patients were treated with antibiotic-impregnated calcium sulfate beads, resulting in a significant decrease in recurrence at 1 year (Khansa et al, 2018). A further prospective comparative analysis found that local debridement combined with antibiotic-impregnated calcium sulfate (STIMULAN®) as a single-stage treatment is effective in treating chronic localised osteomyelitis when compared to debridement alone. However, the authors concluded that its use alone in diffuse osteomyelitis may be less effective (Jagadeesh et al, 2022).

An *in vitro* model also demonstrated reductions in bioburden of between 5 and 8 logs in five of the six biofilms tested with topical release of antibiotics via calcium sulfate (STIMULAN®) beads, as opposed to no difference in biofilm bioburden in the models after simulated systemic therapy (Crowther et al, 2021). It should be noted that, in certain cases, the site and extent of the PU may prevent the use of antibiotic-impregnated beads.

Local antimicrobial dressings

Good wound care should be priority as part of treatment; therefore, antimicrobial dressings should be used in localised infection for wound management (IWII, 2022).

Anecdotally, positive results have been seen in use of negative pressure wound therapy with instillation (NPWTi) using saline or irrigation solution, particularly to help control exudate. Instructions for use state that NPWTi is indicated for use in treated osteomyelitis, which is defined as the patient having received a first dose of antibiotics.

It should be emphasised that even local treatment should not be viewed in isolation, and should be seen as part of a wider MDT effort.

Recurrence and prevention

It is important to remember the cause of osteomyelitis in the presence of PUs: the bone has become infected because soft tissue has broken down. It is, therefore, imperative to prevent pressure damage as far as possible, to prevent PUs from worsening and take measures to reduce the risk of recurrence.

This can be aided by the use of structured protocols in practice. As most patients do not receive treatment within a comprehensive care programme, they face an increased risk of recurrent infection, prolonged antibiotic treatment, foot complications and hospitalisation. Furthermore, residual bone infection increases the risk of reinfection, as osteomyelitis can act as a persistent source of infection, potentially leading to local or systemic spread (Reyes et al, 2024).

Risk reduction

Any patient with an existing PU is, by definition, in the highest category of risk. The risk of further pressure damage or deterioration of the existing wound should be reduced by taking physical measures such as offloading. At-risk patients, such as those with spinal injury or mobility issues, should be assessed to ensure that damage does not continue to occur.

Pressure redistributing support surfaces (e.g. mattress, cushion or other device) may be used to reduce the risk of further skin damage or deterioration.Patient repositioning is also essential to redistribute pressure by changing the areas exposed to load and maximising the body surface area supporting the patient's weight. This should be achieved while avoiding direct pressure on vulnerable areas, particularly bony prominences, to minimise the risk of pressure-related tissue damage (Fletcher, 2023).

It is also important to ensure existing items of equipment are checked regularly for continued suitability and effectiveness. For example, long-term cushion and wheelchair users should have their cushions re-evaluated every 2 years by wheelchair services.

In practice, patients' skin should be checked regularly for signs of pressure damage occurring. The skin should be monitored for changes and it is important to communicate with the patient about checking their own skin if they can and knowing the signs to look out for. It is important to listen to the patient's perspective and their views and feelings on their skin condition. It is also important to encourage patients to take ownership of monitoring their pressure areas, where possible. Engagement is key and prevents changes being missed, especially when multiple different healthcare professionals may be involved in care.

Thorough ongoing observation should be made of existing PUs with osteomyelitis beneath suspected or confirmed. This should include, for example: measurements (including undermining, to determine size improvement/deterioration/stasis); exudate level and consistency; new odours and skin colour changes beyond the wound edge (which may indicate further pressure or soft tissue infection).

Skin assessment should include an awareness of skin tone to ensure that changes are not missed, as there has historically been a focus on checking for 'redness' (Wounds UK, 2021). In dark skin tones, colour changes may be more subtle and not necessarily red. It has been found that patients with dark skin tones are more likely to be diagnosed with higher-category PUs due to a lack of accurate assessment and early identification (Oozageer Gunowa et al, 2018).

Monitoring

Currently, there is a lack of longer-term follow-up and monitoring when patients are discharged from care. Follow-up testing should ideally be carried out to ensure that osteomyelitis has been effectively treated and to reduce risk of further complication or recurrence of infection.

RECURRENCE AND PREVENTION

Even when treatment has been successful, if the patient remains at risk and has comorbidities, the risk of recurrence is high, particularly over the healed wound. Long-term follow-up is recommended to monitor for recurrent infection and potential adverse effects associated with antimicrobial and other medications, with referral to specialist services where clinically indicated (BMJ, 2021).

Data capture

It is evident that there is a lack of evidence around osteomyelitis in PUs, which must be addressed to improve practice. Evidence begins with data capture, which is needed in all settings and at all levels. Monitoring and documenting patients is crucial.

The current lack of evidence means that patients are not receiving the most effective care and support. Evidence-based care is needed in this area to inform practice.

A paradigm shift

A complete change in mindset is needed, as well as raised awareness and knowledge to inform practice. Through the development of this document, it became apparent that there is currently a lack of a joined-up approach incorporating MDT-working and shared responsibility.

Evidence from clinical practice suggests that improving patient outcomes requires a coordinated, multidisciplinary approach involving collaboration between community, acute care and other relevant healthcare professionals. Patients with PUs and osteomyelitis are generally complex and the reason for their PU is often multifactorial. Unless all of these factors are addressed, it is unlikely that meaningful improvement will be seen.

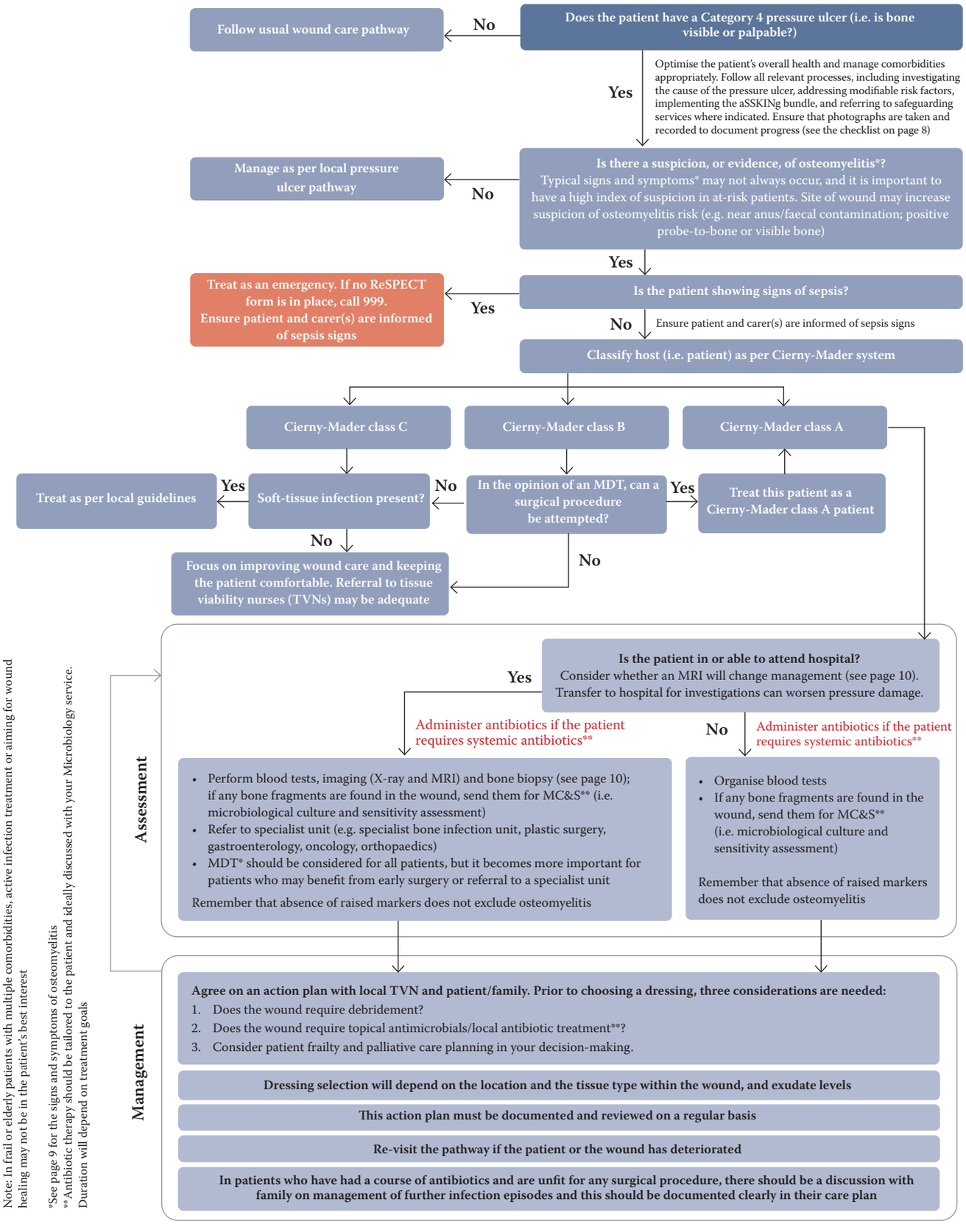
Multidisciplinary working can be challenging to achieve in practice, with lack of communication between departments and disciplines. It should be acknowledged that — while this should not be the case — staff in many clinical settings can be seen in terms of hierarchy, creating barriers in communication and collaboration. Change needs to start at the 'top' to foster confidence and transparency among all levels of staff.

As the Patient Safety Incident Report Framework (PSIRF; NHS England, 2022) moves the focus from individual incidents to system-wide quality improvement, it must be recognised that we are all accountable for the care that we deliver.

Our hope is that this document empowers clinicians at all levels to help to transform and improve care for patients. Taking the example of the diabetic foot, we have seen that — with drive and support for multidisciplinary working — improved outcomes are possible.

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Appendix 1: A pathway for assessment and management of osteomyelitis in sacral pressure ulcers.



Note: In frail or elderly patients with multiple comorbidities, active infection treatment or aiming for wound healing may not be in the patient's best interest

*See page 9 for the signs and symptoms of osteomyelitis
**Antibiotic therapy should be tailored to the patient and ideally discussed with your Microbiology service. Duration will depend on treatment goals

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