This article will examine current guidelines for the treatment of cellulitis focussing on the assessment process, establishing an accurate diagnosis, differential diagnosis and the management of cellulitis using a multidisciplinary approach. The article will additionally provide local guidelines from a nurse led dermatology cellulitis clinic.

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KEYWORDS
- Cellulitis
- Assessment
- Diagnosis
- Management
- Prevention

Introduction
The Clinical Resources Efficiency Support Team (CREST) provides the latest guidelines on the management of cellulitis in adults.1 The guidelines recognise that cellulitis can affect any part of the body, however it most commonly occurs in the legs. Both authors specialise in lower limb cellulitis working from a dermatology nurse led clinic. Emphasis is on the promotion of a correct diagnosis and management of complex patients. The clinic repeatedly sees patients who have been misdiagnosed with cellulitis and erroneously treated for long periods with antibiotics. The importance of assessment in preventing misdiagnosis will be highlighted along with advice on how to reach a correct diagnosis and tips on management for patients in both primary and secondary care.

Aetiology
Cellulitis is an acute bacterial infection of the skin and subcutaneous tissue that spreads rapidly without treatment. Streptococcus pyogenes (27%), and Staphylococcus aureus (51%) are the most common infecting organisms. Atypical organisms are more likely to be found in children, the immunocompromised and elderly.2 The infection develops following failure of the skin’s integrity secondary to trauma, surgery, insect bites, tinea infection, and often in patients with existing skin conditions such as eczema and psoriasis.

Epidemiology
Cellulitis is a common infection. In the year 2013-2014, there were 104,598 cases treated in secondary care.4 – and this figure does not include cases treated in primary care. In the period 2010-2016, in our clinic, of the 1,020 patients seen, 487 did not have cellulitis, 504 were treated for cellulitis, 262 of whom were treated with intravenous antibiotics, the remainder with oral antibiotics. We treat in-patients under a dermatology service, the emergency cellulitis clinic typically sees patients referred from primary care. There is obviously a tremendous financial burden that might be alleviated to an extent by the accurate diagnosis of cellulitis. This would not only prevent unnecessary antibiotic therapy and hospital admission, but enable treatment of the correct disorder, thus saving patient suffering.

Signs and symptoms
Cellulitis is characterised by an acute onset of erythema, pain, heat and swelling. In severe cases, blistering may develop. Accumulation of oedema, either pre-existing or secondary to the inflammation, may lead to lymphangitis and lymphadenopathy. Flu like symptoms may develop before or after visible manifestation in the skin. The onset of symptoms varies greatly, sometimes over a few hours, sometimes over days.

At risk individuals
There are a number of factors which may predispose an individual to the development of cellulitis:

- Previous episodes of cellulitis will increase the risk of further incidence, as each occurrence damages the venous and lymphatic drainage systems. Inevitably, repeated episodes may cause sufficient cumulative damage leading to the development of lymphoedema
- Obesity
- Diabetic patients are at much higher risk of circulatory problems and are at a much higher risk of skin failure and subsequent development of infection. Also, as their healing is delayed, it may result in chronic ulceration. Their detection of a problem may be hindered by peripheral neuropathy

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Eczema and psoriasis. Dry, cracked skin will provide a potential entry point for bacteria.

Lymphoedema. Protein rich lymph provides a favourable medium for bacteria to develop. It affects the condition of the skin, and hyperkeratosis, lichenification and fibrosis may be present. Consequently, breaches in the skin are common.

Post-operative

Immunocompromised

Venous insufficiency may lead to chronic oedema and skin changes seen in the presence of varicose eczema and lipodermatosclerosis.

Poor management

Failing to make a correct diagnosis, or any delay in diagnosis, could lead to the development of sepsis and potentially death. There are currently initiatives underway to expedite the early detection of sepsis. Inappropriate treatment with antibiotics may expose the patient to unpleasant side effects and the development of resistance. In this instance, the patient will also be left to suffer the symptoms of an undiagnosed condition.

We often see patients with post-cellulitic sequelae; oedema, erythema, hyperpigmentation. It is generally not understood that the aftermath of an episode of cellulitis may take as long as a year to settle fully, yet even then the limb may not return to its previous size and discolouration from haemosiderin deposits will never clear completely.

Non-treatment of the post-traumatic oedema can lead to the development of lymphoedema and skin breakdown, which may result in ulceration and further infection.

Nursing assessment

The assessment process is crucial in making a diagnosis of cellulitis. A clear accurate history with a precise timeline detailing the appearance of symptoms will help to facilitate a correct diagnosis and enable safe, effective treatment. An accurate diagnosis is dependent upon the questions asked and interpretation of the answers given, alongside any physical evidence. It is important to mention that although cellulitis can affect any part of the body, most commonly the head, neck and limbs, our clinic is limited to lower limb cellulitis only.

When did it start

How did it start/how do you feel

Fever/headache/night sweats

General malaise

Where did it manifest first

Skin condition

Skin breaches; trauma, insect bites, tinea, recent surgery

Consider co-morbidities

Diabetes

Is the patient immunocompromised due to illness or treatment e.g. methotrexate, ciclosporin, systemic corticosteroids, biologics

Existing skin condition e.g. eczema, psoriasis

Venous insufficiency

Systemic symptoms must be considered in conjunction with the physical presentation and the patient’s general health and co-morbidities. Patients often report rapid onset over a few hours, yet this is not always the case and the infection could develop over a day or two. There is almost always significant pain in the affected limb. In the presence of cellulitis, erythema will quickly advance, this will be illustrated clearly by the initial outlining of the margins. It is important to attempt to identify a portal of entry. Ingress is gained
where the skin has failed, this may not be obvious in the first instance. Maceration of the toe webs caused by tinea pedis is common as are insect bites. Cracks and fissures in dry hardened skin also provide a point of entry.7

Often there is no identifiable portal. Lymph fluid is rich in proteins and provides an excellent medium for the growth of bacteria, and it is well documented that patients with lymphoedema have a propensity to develop cellulitis.8

Differential diagnosis
In consideration of a differential diagnosis there are a number of conditions to exclude:
- Deep vein thrombosis
- Varicose eczema
- Lipodermatosclerosis
- Chronic inflammation secondary to lymphoedema/chronic oedema
- Drug eruption.

Bilateral cellulitis is very rare indeed.1 The authors have only encountered one case in eight years, and this is probably the most important point for diagnostic exclusion of cellulitis. It has been identified as a common and expensive misdiagnosis.3

In the presence of varicose eczema, the skin will be erythematous with dry flaking skin. There may be weeping of lymph fluid, crust and inflammation. The affected skin and tissues will be tender; but not as painful as in cellulitis and acute lipodermatosclerosis.5

Lipodermatosclerosis is a chronic condition which is subject to flares. In the acute phase there will be severe erythema, tenderness, induration, pain on palpation and marked fibrotic skin changes. The limb will have a distinctive inverted champagne bottle shape.9 During an acute phase, one or both limbs may be affected. Confusion might ensue, bearing in mind the initial statement describing cellulitis as a largely unilateral infection. However, on close examination of the unaffected leg, sequelae from previous episodes of eczema and lipodermatosclerosis should be detectable.

If a DVT is under consideration, contributing factors should be established, e.g. previous DVT, blood factor disorders, AF, immobility and travel, recent surgery/fractures. A referral should be made if there is any doubt to the appropriate speciality for example DVT clinic to perform an ultrasound.

Cutaneous drug eruptions in the early stages present with erythematous raised patches. The patches commonly appear on the abdomen and back, however it is not unusual for the rash to originate on the legs, consequently it is important to have accurate information on medications.7

Unfortunately, many conditions present with similar symptoms and, as with any infection, not all symptoms will be present and concurrent co-morbidities may blur the clinical picture. Systemic symptoms are important although, commonly, if the cellulitis is not severe or the patient is seen early in the disease process, they may not be present.

Investigations
The below investigations can be useful tool to diagnose cellulitis. They can be completed within the community and can provide a baseline to monitor treatment.
- Vital signs
- Full blood count and C-reactive protein (CRP)
- Swabs (only if the skin is broken, pus present)
- Mycology (skin scrapings and nail clippings if fungal infection suspected).

Blood cultures are not useful, CREST guidelines on the management of cellulitis in adults recommends taking blood cultures only in the presence of significant systemic upset including a pyrexia greater than 38 degrees.1 CRP is a non-specific inflammatory marker; alternative reasons for a high result should be considered. In the presence of infection we would expect to see a result in the 100s.10 We would also expect to see a raised white blood cell count but should not be relied on in isolation.

Treatment
The ERON classification is widely used in the diagnosis and treatment of cellulitis, it is presented as follows in the CREST guidelines.11

- CREST defines the severity using 4 stages:
  - Class 1 Patients have no signs of systemic toxicity, have no uncontrolled co-morbidities and can usually be managed with oral antimicrobials on an outpatient basis.
  - Class 2 Patients are either systemically ill or systemically well, but with a co-morbidity such as peripheral vascular disease, chronic venous insufficiency or morbid obesity which may complicate or delay resolution of their infection.
  - Class 3 Patients may have a significant systemic upset such as acute confusion, tachycardia, tachypnoea, hypotension, or may have unstable co-morbidities that may interfere with a response to therapy or have a limb threatening infection due to vascular compromise.
  - Class 4 Patients have sepsis syndrome or severe life threatening infection such as necrotizing fasciitis.

There is no national policy for the treatment of cellulitis. Treatment is usually dictated by local policy along with identification and targeting of the individual infecting organism. Past studies go so far as to suggest that closely following ERON might lead to over treatment, especially in the less severe cases.2 An alternative guide might be the 2011 'Dundee Classification of Skin and Soft Tissue Infections'.12

Our local policy dictates intravenous flucloxacillin 500mg - 1g and benzylpenicillin 1.2g for in-patients, clarithromycin 500mg for those who are penicillin allergic. Intravenous ceftriaxone 2g once daily for out-patients, if penicillin allergic, intravenous teicoplanin once daily dose depends on weight. We rarely
administer IVs for more than 3 days, and when IV’s are administered, we usually follow up with 7 days of oral antibiotics. In less severe cases we would initially treat with 7 days of oral Flucloxacillin 500mg and Penicillin V 500mg. Analgesia must be considered. If over the counter pain killers are insufficient, a prescription for stronger analgesia will be given.

Secondly, it is important to initiate a good skin care routine along with antibiotic therapy. The skin will be damaged to a greater or lesser degree depending on the severity of the cellulitis.

Effective cleansing using an emollient with an antimicrobial component is the first step, such as hibiscrub added to the water or dermol 500 lotion. This should be followed by application of an emollient, cream or ointment depending on the skin condition. Use of a moderate strength topical steroid can be useful in reducing erythema and irritation. The application of zinc paste bandage may be soothing and also occludes the topicals preventing evaporation and therefore increasing their effectiveness. Also paste bandages will inhibit the accumulation of oedema. Patients should be encouraged to rest and elevate the affected limb in an effort to lessen dependent oedema. Even at this early stage compression would be beneficial. There are no contraindications for compression and no clinical research to suggest that compression causes the infection to spread. We would therefore encourage the use of compression as soon as possible.

Post cellulitis

Patients should be made aware of the possibility of oedema, hyperpigmentation, haemosiderin deposits, pain and the increased possibility of recurrence. Cellulitis damages lymphatic vessels which can lead to long term problems, the effects of which are often erroneously interpreted as a continuation of the acute episode. Generally, it is unnecessary to continue with antibiotics beyond 14 days. The residual erythema, swelling and discomfort will however remain due to post-inflammatory changes. The sequelae should be treated with a moderate strength topical steroid and compression. It is important to note that diuretics should play no part in the treatment of post cellulitic or indeed chronic oedemas. Diuretics should only be employed in oedema secondary to electrolyte imbalances and congestive heart failure.¹²

Prevention

- Maintain good skin condition
- Take care to protect against insect bites
- Always wear footwear
- Keep feet and toes clean and dry
- Wear compression garments
- Prophylactic antibiotics (if clinically indicated).

Prophylactic antibiotics continue to be a contentious issue along with the existence of ‘chronic’ cellulitis. The UK Dermatology Clinical Trials Network’s PATCH Trials Team¹⁴ and the British Lymphology Society (BLS)¹⁵ cellulitis guidelines advocate the use of low dose oral antibiotics if a patient has experienced two or more episodes of cellulitis in one year. The recommendations are for penicillin dose 250mg twice daily or clarithromycin 250mg once daily or erythromycin 250mg twice daily. The authors of the PATCH trials concede that there is no statistical significance seen in the reduction of cellulitis rates for penicillin V prophylaxis.

Case Study 1

(see Figure 2)

Picture supplied by the Medical Illustration Department at the Norfolk & Norwich University Hospital

A typical patient seen in the clinic

A 78 year old lady was referred to the clinic by her GP with worsening cellulitis of her legs. Her clinical history detailed her legs as having been red, tender and oedematous for approximately 8-10 months. She had received antibiotic treatment intermittently throughout this period. Additionally, she had a history of rheumatoid arthritis that was managed with methotrexate tablets and a biologics injection. The diagnosis of cellulitis precluded her from receiving her biological injection, due to its effect on the immune system, these drugs are contraindicated in the presence of infection. She had consequently experienced a significant deterioration in her arthritis resulting in increased pain and decreased mobility which was impacting severely on her quality of life.

The correct diagnosis was varicose eczema with mild inflammatory changes brought about by oedema. On consideration of her clinical history, it is likely that she had never had cellulitis. This misdiagnosis resulted in her being treated for months with a number of different and unnecessary antibiotics.

Most importantly, being diagnosed correctly meant she was able to recommence her biologics injection, which would hopefully begin to manage her pain and help her to recover her mobility.

A treatment plan for the varicose eczema was initiated; momethasone butyrate 0.1% ointment to be applied once a day along with temporary graduated compression (Tensoshape). She was given an
A 45-year-old man was referred to the clinic by his GP with worsening cellulitis of his left leg. During the assessment and on taking a clinical history, it was noted that the patient felt sore between his toes and recalled scratching the area a few days previously. He reported feeling like he was getting a cold, slightly feverish and had also developed a rash to the top of his foot. His GP had given him oral antibiotics 48 hours previously, however the rash had spread from his foot to his thigh.

He received written and verbal information on the management of tinea pedis and the importance of maintaining skin integrity.

**Case Study 2**

(see Figure 3)

*Picture supplied by the Medical Illustration Department at the Norfolk & Norwich University Hospital*

He had an erythematous, swollen, hot and painful leg with a mild pyrexia of 37.8°C, he said he felt febrile. He had no other significant medical history and was taking no regular medications.

The treatment plan was initiated with 2g of intravenous ceftriaxone once a day for 3 days. The patient attended the clinic as an out-patient. He was also treated with topical hydrochloride 1% terbinafine to his toe webs and zinc paste bandage to his leg. The antibiotics were switched after 3 days to oral flucloxacinil 500mg and penicillin V 500mg four times a day for a further 7 days.

**Conclusion**

Clearly the emphasis must be on assessment in facilitating the correct diagnosis of cellulitis. Treatment is often the easy part. It is frustrating to encounter patients who have been treated unnecessarily with a multitude of antibiotics over weeks, months and occasionally years.

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The challenges facing us due to antibiotic resistance are very present, consequently the eradication of doubt in diagnosing cellulitis is of paramount importance. We appreciate the need for safety, it would be dangerous not to treat in the presence of doubt. Our goal is to aid other clinicians in the recognition of cellulitis. A timely diagnosis will impact positively on both the patient’s treatment and recovery.

**References:**


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