CREST

CLINICAL RESOURCE EFFICIENCY SUPPORT TEAM

GUIDELINES ON THE MANAGEMENT OF CELLULITIS IN ADULTS

June 2005

These guidelines have been published by the Clinical Resource Efficiency Support Team (CREST), which is a small team of health care professionals established under the auspices of the Central Medical Advisory Committee in 1988. The aims of CREST are to promote clinical efficiency in the Health Service in Northern Ireland, while ensuring the highest possible standard of clinical practice is maintained.

These guidelines have been produced by a multidisciplinary sub-group of health care professionals Chaired by Dr Raymond Fulton. CREST wishes to thank them and all those who contributed in any way to the development of these guidelines.

Further copies of this booklet and laminated chart may be obtained from:

CREST Secretariat
Room D1
Castle Buildings
Stormont
BELFAST
BT4 3SQ
Tel 028 9052 2028

Or you can visit the CREST website at: www.crestni.org.uk

ISBN 1-903982-12-X

CREST

CLINICAL RESOURCE EFFICIENCY SUPPORT TEAM

CONTENTS

CREST

CLINICAL RESOURCE EFFICIENCY SUPPORT TEAM

1. INTRODUCTION

Cellulitis in adults is a common medical condition taking up a large number of occupied bed days in Acute hospitals. In 1985 in the UK, skin and subcutaneous tissue infections resulted in 29,820 hospital admissions and a mean occupancy of 664 hospital beds each day [1]. One survey concluded that it accounted for around 3% of emergency medical consultations at a UK district general hospital. Consequently, it represents an important healthcare issue with substantial resource and financial implications for the majority of acute trusts. In Northern Ireland in 2003, there were 2,081 admissions with a discharge diagnosis of cellulitis and an average length of stay of 11 days.

Inappropriate diagnosis of cellulitis is a problem and would need prospective rather than retrospective studies to quantify the extent. Cellulitis must be differentiated from lower leg eczema,[2] oedema with blisters, acute venous problems including deep venous thrombosis (DVT), thrombophlebitis and liposclerosis, and vasculitis [3].

Despite the size of the problem, there is a relative lack of good evidence-based literature for the management of patients with cellulitis. There is only one published set of guidelines using a systematic approach [4] and no national guidelines. Trials of treatment options are often small and inconclusive. No randomised controlled trials or observational studies look at the effects of treating predisposing factors on the recurrence of cellulitis or erysipelas. As a result of this clinical practice is variable and often inconsistent.

Cellulitis is a spreading bacterial infection of the dermis and subcutaneous tissues. For the purposes of these guidelines, erysipelas will be classified as a form of cellulitis rather than a distinct entity. The most common infective organisms in adults are streptococci (esp. *Strep. pyogenes*) and *Staph. aureus* [1]. Less common organisms include *Strep. pneumoniae, Haemophilus influenzae*, Gram-negative bacilli and anaerobes [5]. Research data on the risk factors for developing cellulitis is minimal. However, a case control study in 1999 found that a potential site of entry (eg. leg ulcer, toe web intertrigo, traumatic wound), lymphoedema, leg oedema, venous insufficiency and being overweight were all factors that may predispose to cellulitis [6].

Following cellulitis of the leg, around 7% of patients develop chronic oedema and a few patients develop persistent leg ulceration. 29% of patients develop a recurrence of cellulitis within a mean of 3 years, with venous insufficiency being the commonest predisposing factor [7].

Necrotizing fasciitis (NF) is a rapidly progressive and destructive soft tissue infection that involves the subcutaneous tissue and fascia. Skin may initially be spared and presenting signs

of NF are often non-specific and may resemble cellulitis. NF is rare but has a high mortality of approximately 50%. Clinicians must be alert to the clinical signs of NF as it is essential to avoid delay in appropriate treatment with antibiotics and urgent surgical exploration and debridement. There are some important diagnostic clues and appropriate emergency investigations (see Appendix 3).

These guidelines will exclude specific reference to orbital or periorbital cellulitis. However, because of potential complications from the former, eg. decreased ocular motility, decreased visual acuity and cavernous sinus thrombosis, it is vital to distinguish the two. Both must be referred urgently to Ophthalmology.

Cellulitis secondary to diabetic foot ulceration should be managed per the CREST Guidelines for Wound Management in Northern Ireland, October 1998.

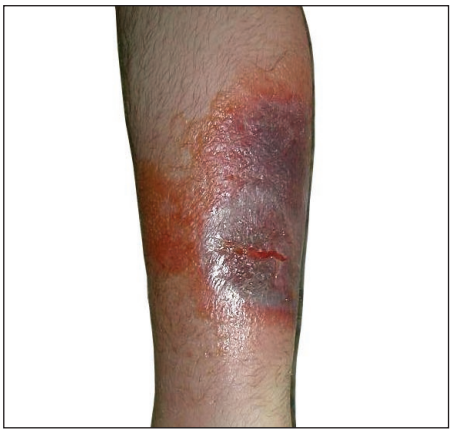
2. CLINICAL DIAGNOSIS OF CELLULITIS

Cellulitis presents as the acute and progressive onset of a red, painful, hot, swollen and tender area of skin. The edge of the erythema may be well demarcated or more diffuse and typically spreads rapidly. Constitutional upset with fever and malaise occurs in most cases, and may be present before the localising signs. Blistering/bullae, superficial haemorrhage into blisters, dermal necrosis, lymphangitis and lymphadenopathy may occur [1]. The leg is the commonest site and there may be an identifiable portal of entry, for example, a wound, an ulcer or signs of tinea infection. Bilateral leg cellulitis is extremely rare. The use of simple clinical diagnostic criteria should be encouraged and should avoid over diagnosis and inappropriate investigations and antibiotics [2]. The absence of typical clinical features should make one think of the main differential diagnoses, especially:

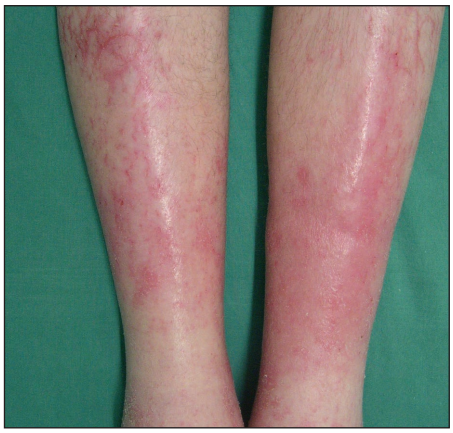
1. Varicose eczema which is often **bilateral** with crusting, scaling and itch or other lower leg eczema.
2. DVT with pain and swelling without significant erythema.
3. Acute liposclerosis which may have pain, redness and swelling in the absence of significant systemic upset [3].

Other differential diagnosis include lower leg oedema with secondary blistering, erythema nodosum, other panniculities or vasculitis and pyoderma gangrenosum.

Complications include fasciitis, myositis, subcutaneous abscesses, septicaemia, post streptococcal nephritis and death.



Typical Cellulitis



Bilateral Varicose Excema

2.1 Clinical Classes of Cellulitis

A classification system can serve as a useful guide to admission and treatment decisions. This classification was devised by Eron [4] for skin and soft tissue infections.

Class I 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 II 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 III 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 IV patients have sepsis syndrome or severe life threatening infection such as necrotizing fasciitis.

Clinical findings alone are usually adequate for diagnosing cellulitis, particularly in non-toxic immunocompetent patients.

2.2 Laboratory Investigations

Although non-specific, nearly all patients have a raised white cell count and elevated ESR or C-reactive protein. Normal results make a diagnosis of cellulitis less likely.

Culture of any local lesion is generally unrewarding – intradermal needle aspiration yielding positive culture results in around 10% of cases and punch biopsy in 20% [6]. However where there is an open wound, drainage or an obvious portal for microbial entry, a swab should be taken for culture.

Blood cultures are rarely positive (2-4%) [5,6] and contaminants may outnumber pathogens [5]. **Blood cultures should not be undertaken routinely but be reserved for patients where the infection has been graded as Class III or Class IV where they are more likely to yield the causative organism.**

Serological tests such as ASOT or AntiDNAse B only provide retrospective evidence in selected refractory cases.

Laboratory Investigations

Class II-IV	Selected patients
- FBC - ESR/CRP - U+E - Culture any skin break/ ulceration/ blister fluid	- Blood cultures only Class III or Class IV infections - Streptococcal serology only in refractory cases where diagnosis is in doubt - Skin biopsy where differential diagnosis includes other non-infectious inflammatory lesions

3. DRUG THERAPY AND TREATMENT

Class I patients can usually be managed with oral antimicrobials on an outpatient basis.

Class II patients are suitable for short-term (up to 48 hours) hospitalisation and discharge on outpatient parenteral antimicrobial therapy (OPAT), where this service is available.

Class III and Class IV patients require hospitalisation until the infected area is clinically improving, systemic signs of infection are resolving and any co-morbidities are stabilised. Patients with suspected necrotising infection require urgent surgical assessment and extensive debridement of the affected area.

3.1 Suitable Drug Therapy for Typical Cellulitis

	First line	Second line
Class I	Flucloxacillin 500mg qds po	Penicillin allergy: Clarithromycin 500mg bd po
Class II	Flucloxacillin 2g qds IV **or** * Ceftriaxone 1g od IV (OPAT only)	Penicillin allergy: Clarithromycin 500mg bd IV **or** Clindamycin 600mg tds IV
Class III	Flucloxacillin 2g qds IV	Penicillin allergy: Clarithromycin 500mg bd IV **or** Clindamycin 900mg tds IV
Class IV	Benzylpenicillin 2.4g 2-4 hourly IV + Ciprofloxacin 400mg bd IV + Clindamycin 900mg tds IV (If allergic to penicillin use Ciprofloxacin and Clindamycin only) **NB Discuss with local Medical Microbiology Service**	

*** Must not be used in penicillin anaphylaxis**

3.2 Rationale

The vast majority of cases of cellulitis are caused by beta-haemolytic streptococci or *S.aureus*. Empiric antimicrobial therapy should therefore provide adequate cover for these micro-organisms.

Flucloxacillin exerts a bactericidal effect on streptococci as well as staphylococci and for this reason has been suggested as monotherapy orally for Class I infections and initially intravenously for Class II and Class III infections. Custom and practice has traditionally combined the use of benzylpenicillin and flucloxacillin in the management of hospitalised patients with cellulitis. The short half-life of benzylpenicillin necessitates administration at

least four hourly and when combined with intravenous flucloxacillin results in ten doses of an antimicrobial agent over a twenty-four hour period. In most cases this is not seen as practical or necessary. If a recognised pathogen is isolated from blood cultures seek specific advice from a Medical Microbiologist.

Although co-amoxiclav also exerts a bactericidal effect on streptococci and staphylococci this antibiotic has a considerably broader spectrum of activity including Gram-negative organisms and anaerobes and is therefore unnecessary in this situation.

Penicillin allergy: It is essential to obtain a detailed history of a patient's reaction to penicillin as this may allow a clinician to exclude allergy. The vast majority of patients with a history of penicillin rash tolerate cephalosporins without significant reaction [1]. If the patient has experienced an anaphylactic reaction or immediate urticarial rash to a penicillin, this class of drug must be avoided. Macrolide antibiotics or clindamycin are suitable alternatives.

Clindamycin suppresses toxin production by group A streptococci, *C. prefringens* and *S. aureus*. It is for this reason that it is used in the management of necrotizing fasciitis. It has been associated with cases of *Clostridium difficile* diarrhoea and in non-life threatening infection the development of diarrhoea should prompt discontinuation.

In the past, it has been standard practice to hospitalize Class II patients with serious soft tissue infections, such as cellulitis. However, those of Class II severity can be treated safely and effectively with OPAT followed by transition to oral agents as the infection resolves. Ceftriaxone has been listed for the management of Class II infections. This agent is administered once daily making it a suitable agent if OPAT is locally available and considered appropriate. Its safety and efficacy in this situation is well established [2,3,4].

3.3 Non- responders

There may be an increase in erythema in the first 24-48 hours of treatment possibly related to toxin release. Further deterioration should prompt consultation with the local Medical Microbiology/Dermatology/Tissue Viability Service or Surgical Team as appropriate.

3.4 Oral Antimicrobial Switch and Hospital Discharge

Although criteria for the switch from parenteral to oral antibiotics for patients with community acquired pneumonia have been studied [5,6] there is less information in relation to cellulitis. It has been suggested that patients can be switched safely to oral antibiotics within 3.5 days of therapy for uncomplicated cellulitis [7].

Use of IV therapy for longer than 3-4 days does not correlate with better outcomes [8].

Delay of discharge until complete resolution of fever and all signs of inflammation is usually unnecessary [9,10].

Suggested Criteria for Oral Switch and/or Discharge

- Pyrexia settling
- Co-morbidities stable
- Less intense erythema
- Falling inflammatory markers

Suitable Agents for Oral Switch Therapy

– Flucloxacillin 500mg qds

If penicillin allergy-

– Clarithromycin 500mg bd

– Clindamycin 300mg qds

If an oral preparation of the parenteral drug is available this will, on most occasions, be the most appropriate oral switch agent.

Clarithromycin and clindamycin are suitable agents in the penicillin allergic patient.

3.5 Discontinuation of Antibiotics

The duration of antimicrobial therapy for cellulitis has not been extensively studied. Most cases of uncomplicated cellulitis can be successfully treated with 1-2 weeks of therapy although complicated cases may require more prolonged therapy.

3.6 Suitable Drug Therapy for Atypical Cellulitis

Risk Factor	First line	Penicillin allergy
Human bite	Co-amoxiclav 625mg tds po	Clarithromycin 500mg bd po **or** Doxycycline 100mg bd po **and** Metronidazole 400mg tds po
Cat/Dog bite	Co-amoxiclav 625mg tds po	Doxycycline 100mg bd po **and** Metronidazole 400mg tds po
Exposure to fresh water at site of skin break	Ciprofloxacin 750mg bd po **and** Flucloxacillin 500mg qds po	Ciprofloxacin 750mg bd po **and** Clarithromycin 500mg bd po

The bacterial aetiology of cellulitis associated with bites or non-chlorinated water is more diverse than “simple” cellulitis.

In the case of human bites cover for mouth anaerobes as well as staphylococci and streptococci is essential and provided with co-amoxiclav monotherapy. Combination therapy is recommended in cases of penicillin allergy. In animal bites co-amoxiclav also provides cover for other common Gram-negative pathogens such as Pasturella multocida. In cases of penicillin allergy clarithromycin does not provide this Gram-negative cover and doxycycline is recommended.

4. LOCAL MANAGEMENT OF CELLULITIS

Management of the locally affected area should include the following:

- Adequate analgesia to ensure pain relief
- Monitoring and management of any pyrexia
- Consider hydration – intravenous/oral
- Recording of the site and/or limb affected
- Mark off the extent of erythema present on admission

If applicable:

- Measurement of the limb
- Elevation of the limb
- Use of a bed cradle

4.1. Blistering

In some instances cellulitis may lead to the skin blistering and subsequent breakdown of the skin.

Where there is potential for blisters to burst spontaneously, proactive management is advocated. This includes aseptic aspiration and/or deroofing of the blister. If in doubt, seek specialist advice.

4.2. Broken and Exudating Skin

The impact of the cellulitis on the skin is to cause tension and swelling which in some cases leads to ulceration and subsequent loss of large amounts of exudate.

Products normally used for management of wound exudate should be considered and selection of these will depend on the site and size of area to be covered.

Topical antibiotics should not be used in the management of cellulitis.

4.3. Compression Bandages

Once the critical stage of swelling and redness has subsided and the patient is reasonably pain free, the patient should be assessed for compression bandaging as per the CREST Guidelines for Wound Management in Northern Ireland, October 1998.

4.4 Lymphoedema

Patients with lymphoedema require referral to appropriate lymphoedema services.

5. RISK OF RECURRENCE OF CELLULITIS AND NEED FOR PROPHYLAXIS

Studies on recurrence rates for cellulitis show that 29% of patients who have previously been admitted to hospital with cellulitis develop a recurrence within a mean of 3 years [1]. Other reported studies show 17% recurrences but no defined follow-up time [2] and a 12% recurrence after a follow-up of only 6 months [3]. Strobart 1985 [4] demonstrated a recurrence rate of 34% in 103 patients who had 2 episodes of erysipelas followed for a mean of 3.3 years. Venous insufficiency has been reported to be the commonest predisposing factor [1]. Other studies show that lymphoedema is the most important risk factor in the development of recurrent cellulitis [5]. As lymphoedema and venous insufficiency are often associated, it would clearly be best to combine these two as the main risk factors for recurrent cellulitis. Each episode of cellulitis adds to the lymphatic damage. Therefore, prophylaxis should be considered for patients with recurrent episodes.

5.1 Long-term Prophylaxis

Cellulitis is presumed to be caused mainly by streptococci. However in more than 80% of cases a pathogen is not identified and the pathogenesis of recurrent episodes of cellulitis is poorly understood. Although there is weak and inconclusive evidence on whether long-term antibacterial prophylactic therapy prevents recurrent cellulitis, it may be worth trying for 1 – 2 years in patients with predisposing conditions who have had at least 2 episodes of cellulitis at the same site [11, 12]. Antibiotic prophylaxis for recurrent cellulitis is purely empirical and optimal treatment and prophylaxis in these patients remains to be determined [5]. Prophylaxis may be more effective in patients without predisposing factors [13]. Early patient initiated treatment rather than long-term prophylaxis may be preferable [14].

Small series have reported benefit from prophylaxis with low dose Penicillin V or Erythromycin (both typically 250mg bd) or with intermittent IM depot Penicillin [6, 7, 8, 9, 10]. However it is not proven whether a prolonged course of antibiotics after a single acute episode will prevent future recurrences.

Propyhlaxis for Recurrent Cellulitis

- 2 or more episodes at the same site
- Penicillin V 250mg bd or Erythromycin 250mg bd for up to 2 years

6. CHANGING PRACTICE

Changing Clinical Practice – What Works?

There is little evidence that passive dissemination of guidelines alone changes behaviour [1,2]. However, guidelines can change clinical practice if they take account of local circumstances, are disseminated through active educational interventions and are implemented using patient-specific reminders [3]. Multi-faceted interventions are typically more effective than single interventions, particularly if they address barriers to change [4], are focused [5], or include reminder systems [6]. Audit and feedback have mixed results with small to moderate improvements in performance [7,8].

While no intervention works in all circumstances, current evidence supports active, sustained education, reminder systems, and a commitment to continuous review and improvement. The key elements to successful implementation of these cellulitis guidelines therefore include:

- A local champion to initiate and maintain interest in continually improving cellulitis management
- A network for local champions to allow them to share with each other what works and what does not work in changing practice
- Regular educational events to increase knowledge of recommended cellulitis treatment and ultimately, show improvement in practice
- A simple system to remind key staff of recommended practice day-to-day

Specific implementation recommendations are given in Appendix 2.

APPENDIX 1

Membership of the CREST Management of Cellulitis Sub-Group:

Chair:

Dr Raymond Fulton
Consultant Dermatologist, Altnagelvin Area Hospital

Members:

Dr Louise Doherty
Specialist in Public Health Medicine, Letterkenny, ROI

Mrs Dianne Gill
Principal Pharmacist, Antrim Area Hospital

Dr Anne Marie Harney
General Practitioner, Downpatrick

Dr Carolyn Harper
Consultant in Public Health Medicine, NHSSB

Dr Hilary Jenkinson
Consultant Dermatologist, Antrim Area Hospital

Dr Anne Loughrey
Consultant Microbiologist, Belfast Link Labs, Belfast City Hospital

Ms Eileen Martin
Ward Sister, Craigavon Hospital

Ms Jenny Mullan
Community Tissue Viability Nurse, Newry and Mourne HSS Trust

Dr Clive Russell
Consultant Physician, Tyrone County Hospital

Dr Mike Scott
Chief Pharmacist, Antrim Area Hospital

Ms Anne Witherow
Tissue Viability Nurse, Altnagelvin Area Hospital

Secretariat:

Mr Gary Hannan

APPENDIX 2

Implementation

Champion

Recommendation: Each Trust should identify a champion who will promote implementation of recommended cellulitis management as outlined in these guidelines. As the person who leads implementation over a sustained period of time, the champion should be someone who is committed to and has a professional interest in improving care for patients with cellulitis.

Support Network

Recommendation: The cellulitis champions in each Trust should form a regional support network to share ideas on how to implement these guidelines. The network would provide a forum to discuss and resolve the challenges champions will face in the implementation of these guidelines. The network can be as simple as an email group where each champion can seek and provide advice to other champions on how to change practice. The network therefore reduces the burden on each champion as successful interventions and lessons from unsuccessful interventions can be shared easily and quickly across Northern Ireland.

Education

Recommendation: The cellulitis champion in each Trust should promote these guidelines and recommended practice in cellulitis through educational events for key staff. Where possible, they should use existing educational programmes. Educational activities should be repeated rather than one-off. Repeat events should remind staff of recommended treatment and should be used to show the changes made to improve care and the resulting improvement in cellulitis quality indicator rates. Target audiences include, but are not limited to:

- Dermatologists
- Tissue viability nurses
- Medical and nursing staff in Accident and Emergency, general medical and surgical wards where cellulitis patients often present
- Infection control nurses and medical microbiologists
- Community nursing leads, treatment room nurses and district nurses
- General practitioners
- Pharmacists
- Drug and Therapeutic Committees' area prescribing fora to ensure formularies reflect the guidance

Implementation in Secondary Care

Recommendation: Each acute Trust should implement active surveillance for patients with cellulitis. The surveillance system should be simple and should build on existing systems. One option would be to identify a member of staff who would contact the wards where patients with cellulitis are likely to present – mainly general medical and surgical wards. The staff member could simply ask whether or not any patients had a diagnosis of cellulitis or conditions that can present like cellulitis. Patients with these diagnoses could then be assessed by appropriate staff, to confirm the diagnosis and review treatment according to the guidelines. Each Trust could modify this system to fit their own particular circumstances and could test and refine the system to meet their needs. As well as improving case finding, reducing delays in diagnosis and avoiding the costs of inappropriate treatment, an active surveillance system is also an ongoing educational tool as ward staff will be reminded of cellulitis and its management day-to-day.

Implementation in Primary Care

Recommendation: General practitioners and treatment room nurses should incorporate these guidelines as automatic electronic reminders in their information systems. Some existing general practice information systems provide an electronic prompt when a diagnosis is entered. The prompt can include guidelines on recommended treatment and therefore acts as an electronic reminder to the general practitioner or other primary care professional. However, not all general practice information systems support this function and for those that do not, general practitioners may wish to develop other reminder systems when cellulitis or related conditions are suspected.

Quality Indicators

Recommendation: The proposed regional cellulitis champion support network should agree a core set of a small number of key indicators that reflect the quality of cellulitis management. Each indicator should be clearly defined in terms of inclusion and exclusion criteria and the numerator and denominator. The quality of cellulitis management and improvements in the quality can then be measured by each Trust in a standard way across Northern Ireland. Increases in quality indicator rates can also be reported back to staff through repeat educational events as a way of maintaining momentum for further improvement.

Recommendation: The regional cellulitis champion support network should consider the quality indicators listed below as candidates for the core set:

- Proportion of patients with cellulitis who received recommended antibiotics
- % of patients in whom cellulitis was diagnosed correctly on admission
- Class/severity recorded

Data relating to these indicators should be collected frequently, but on a small number of patients using as simple a pro forma as possible. The repeated measurements can then be used to continuously review and improve the quality of clinical care provided.

Recommendation: Measuring improvement in indicator rates should take no more than 10% of the effort used to implement the guidelines and change practice. Measurement should therefore be kept as simple as possible and scaled to keep within the 10% limit. Conversely, resources should be targeted towards supporting champions to test and refine the system changes outlined above. Repeated small-scale measurement should be used by champions and clinical staff to see whether or not the changes they implement are actually leading to better patient care. Measurement is therefore a support tool, not an end in itself.

APPENDIX 3

Necrotizing Fasciitis

Presenting signs of Necrotizing Fasciitis (NF) are often non-specific and may resemble cellulitis. All clinicians must be alert to the clinical signs of NF and if suspected, arrange **urgent surgical referral**. While it is essential to avoid delay in appropriate treatment with urgent surgical exploration and antibiotics, some investigations have been reported as being of use in cases of diagnostic difficulty. These investigations are only appropriate if they can be accessed urgently and must not be allowed to contribute to delayed surgical exploration.

Necrotizing Fasciitis is rare but has a high mortality of approximately 50%. It is a rapidly progressive and destructive soft tissue infection that involves the subcutaneous tissue and fascia. Skin may initially be spared. Diagnosis of NF is mainly clinical with pain, skin erythema, tense oedema, pyrexia, leading to skin necrosis with or without crepitus, bullae and cutaneous numbness. The patient can be classified as having Class IV cellulitis, is usually toxic and the condition often leads to organ failure and death. The aetiology is group A streptococci or polymicrobial. Listed below are the reported useful clinical features and investigations:

1. Worsening pain, out of keeping with the other clinical signs. [1]
2. Laboratory tests
   - (a) Increased WCC >14 x 10^9/l
   - (b) Reduced sodium <135mmol/l [2]
   - (c) Increase in urea >15mg/dl
   - (d) CRP >16mg/dl [3]
   - (e) CK >600u/l
   - (f) Blood culture

The following investigations have been reported as being of use in cases of diagnostic difficulty:

1. Frozen section tissue biopsy [4,5].
2. Plain X-ray showing gas in the subcutaneous tissue (may not be present).
3. CT scan showing abnormal gas in soft tissue and dissecting along fascial planes is highly suggestive of NF, 55% positive [6].
4. MRI may aid in delineating extent in tissue planes involved, but should not delay a surgical exploration [7].

APPENDIX 4

CREST Management of Cellulitis In Adults

Diagnosis

Flu-like symptoms, malaise
onset of unilateral swelling, pain, redness

Decide Classification

Class I	Class II	Class III	Class IV
Patients have no signs of systemic toxicity, have no uncontrolled co-morbidities and can usually be managed with oral antimicrobials on an outpatient basis	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	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	Patients have sepsis syndrome or severe life threatening infections such as necrotizing fasciitis

↓

Lab Investigations

Class II - IV	Selected Patients
FBC ESR or CRP U+E Culture any ulceration or blister fluid	• Blood cultures only Class III or Class IV • Streptococcal serology only in refractory cases where diagnosis is in doubt • Skin biopsy where differential diagnosis includes other inflammatory lesions

↓

Treatment

	First line	Second line
Class I	Flucloxacillin 500mg qds po	Penicillin allergy - Clarithromycin 500mg bd po
Class II	Flucloxacillin 2g qds IV or *Ceftriaxone 1g od IV (OPAT)	Penicillin allergy - Clarithromycin 500mg bd IV or Clindamycin 600mg tds IV
Class III	Flucloxacillin 2g qds IV	Penicillin allergy - Clarithromycin 500mg bd IV or Clindamycin 900mg tds IV
Class IV	Benzylpenicillin 2.4 g 2-4 hourly IV +Ciprofloxacin 400mg bd IV +Clindamycin 900mg tds IV (If allergic to penicillin use Ciprofloxacin and Clindamycin only). **NB Discuss with local Medical Microbiology Service**	

***Must not be used in penicillin anaphylaxis**

Suggested Criteria For Oral Switch and/or Discharge

- Pyrexia settling
- Co-morbidities stable
- Less intense erythema
- Falling inflammatory markers

→

Suitable Agents for Oral Switch Therapy

- Flucloxacillin 500mg qds

If penicillin allergy-

- Clarithromycin 500mg bd
- Clindamycin 300mg qds

Prophylaxis for Recurrent Cellulitis

- 2 or more episodes at the same site
- Penicillin V 250mg bd or Erythromycin 250mg bd for up to 2 years

APPENDIX 5

References

Section 1

1. Morris, A. 2003. Cellulitis and Erysipelas. *Clin Evid 9*, 1804-1809.

2. Quartey-Papafio, C.M., 1999. Lesson of the week: importance of distinguishing between cellulitis and varicose eczema of the leg. *BMJ*, 318, 1672-3.

3. Cox, N.H. 2002. Management of lower leg cellulitis. *Clinical Medicine* 2, 23-27.

4. Soc Fr Derm. 2001. *Ann de Dermatol et Venereol* 128, 463-482.

5. Bisno, A. L. , Stevens, D.L. 1996. Streptococcal infections of skin and soft tissue. *N. Engl. J. Med.* 334, 240-245.

6. Dupuy, A. , Benchikhi, H. , Roujeau, J-C. , et al. 1999. Risk factors for erysipelas of the leg: case control study. *Br. Med. J* , 318 1591-4.

7. Jorup-Ronstrom, C. , Britton, S. 1987. Recurrent erysipelas: Predisposing factors and cost of prophylaxis. *Infection*, 15, 105-6.

Section 2

1. CREST Guidelines for Wound Management in Northern Ireland, October 1998.

2. Kilburn, S. , Featherstone, P. , Higgins, B. , Brindle, F. , Severs, M. 2003. *The Cochrane Library*, Issue 3. Oxford Update Software.

3. Cox, N.H. 2002. Management of lower leg cellulitis. *Clinical Medicine 2*, 23-27.

4. Eron, L. J. 2000. Infections of skin and soft tissues: outcome of a classification scheme. *Clinical Infectious Diseases*, 31, 287.

5. Adults: Perl, B., Gottehrer, N. P. , et al. 1999. Cost-effectiveness of blood cultures for adult patients with cellulitis. *Clinical Infectious Diseases*; 29: 1483-8.

6. Hook, E. W III. , Horton, T. M. , et al. Microbiologic evaluation of cutaneous cellulitis in adults. *Archives of Internal Medicine*; 146:295-7.

Section 3

1. Salkind, A.R., Cuddy, P.G., Foxworth, J.W. 2001 Is This Patient Allergic to Penicillin? An evidence-based analysis of the likelihood of penicillin allergy. *JAMA* 285(19):2498-505.

2. Tice, A.D. 1991 Once daily Ceftriaxone Outpatient Therapy in Adults with Infections *Chemotherapy* 37 Supp1 :7-10.

3. Nathwani, D. 2001. The management of skin and soft tissue infections: outpatient parenteral antibiotic therapy in the United Kingdom. *Chemotherapy* 47 Suppl 1:17-23.

4. Vinen J, Hudson B, Chan B, et al. 1996. A randomized comparative study of once-daily ceftriaxone and 6-hourly flucloxacillin in the treatment of moderate to severe cellulitis. Clinical efficacy, safety and pharmacoeconomic implications. *Clin Drug Invest*;12:221-5.

5. Marrie, T. J. 1997. When to discharge a patient with pneumonia. *J. Resp Dis*, 18: 1071-1079.

6. Ramirez, J. A. , Bordon, J. 2001. Early switch from intravenous to oral antibiotics in hospitalized patients with bacteraemic community acquired Streptococcus pneumoniae pneumonia. *Arch Intern Med, 161*: 848-850.

7. Eron, L. J. 2003. The admission, discharge and oral switch decision processes in patients with skin and soft tissue infections. *Current Treatment Options in Infectious Diseases*, 5 : 245-250.

8. Aly, A.A., Roberts, N.M., Seipol, K.S. et al 1996. Case survey of management of cellulitis in a tertiary teaching hospital. *Medical Journal of Australia* 165, 553-556.

9. Dunn, A.S., Peterson, K. L., Schechter, C.B. et al. 1999. The utility of an in-hospital observation period after discontinuing antibiotics. *American Journal of Medicine* 106, 6-10.

10. Boyter, A.C., Stephen, J., Fegan, P.G., *et al* 1997. Why do patients with infection remain in hospital once switched to oral antibiotics? *Journal of Antimicrobial Chemotherapy* 39, 286-8.

Section 4

No references

Section 5

1. Jorup-Ronstrom, C. , Britton, S. 1987. Recurrent erysipelas: Predisposing factors and cost of prophylaxis. *Infection*, 15, 105-6.

2. Herrmann, W. P. , Galosi, A. , Reinhold, M. 1981. *Diagnostik* 14, 79-82.

3. Jorup-Ronstrom, C. , Britton, S. , Gavlevik, A. , et al. 1984. The course, costs and complications of oral versus intravenous penicillin treatment of erysipelas. *Infection* 12, 390-394.

4. Strobert, C. , Hautkr, Z. , 1985. The importance of local factors in recurrent erysipelas. 60, 712-723.

5. Dupuy, A. , Benchikhi, H. , Roujeau, J-C. , et al. 1999. Risk factors for erysipelas of the leg: case control study. *Br. Med. J* , 318 1591-4.

6. Cox, N.H. , Colver, G.B. , Paterson, W. D. 1998. Management and morbidity of cellulitis of the leg. *J. R. Soc. Med*. 91, 634-637.

7. Duvanel, T. , Harms, M. , Merot, M. , Saurat, J-H. 1986. Evaluation of prophylactic Benzanthine-Pencillin in the prevention of recurrent erysipelas. *Dermatologica* 173, 205-208.

8. Kremer, M., Zuckerman, R. , Avraham, Z. , Raz, R. 1991. Long term antimicrobial therapy in the prevention of recurrent soft-tissue infections. *J. Infection* 22, 37-40.

9. Bourna, J. , Dankert, J. 1988. Recurrent acute leg cellulitis in patients after radical vulvectomy. *Gynaecol Oncol*, 29, 50-57.

10. Sjoblom, A. C. , Eriksson, B. , Jorup-Ronstrom , C. , et al. 1993. Antibiotic prophylaxis in recurrent erysipelas. *Infection*, 21, 390-392.

11. *Drugs and Therapeutics Bulletin 41*. 2003. Dilemmas when managing cellulitis (6) , 43-46.

12. Swartz, M. N. 2004. Cellulitis. *N. Eng. J. Med* , 350, 904-912.

13. Wang, J-H. , Liu, Y-C. , Cheng, D.L., et al. 1997. Role of Benzanthine-Penicillin G in prophylaxis for recurrent streptococcal cellulitis of the lower legs. *Clin. Infect. Dis*, 25, 685-689.

14. Woo, P.C.Y. , Lum , P.N.L. , Wang, S.S.Y. , Cheng, V. C. , Yuen , K.Y. 2000. Cellulitis complicating lymphodaema. *Eur. J. Clin. Microbiol. Infect. Dis*. 19, 294-297.

Section 6

1. Lomas, J. 1991. Words without action? The production, dissemination, and impact of consensus recommendations. *Annu Rev Public Health*;12:41-65.

2. Effective Health Care. 1999. *Getting evidence into practice*. University of York. NHS Centre for Reviews and Dissemination.

3. Effective Health Care. 1994. *Implementing clinical guidelines: can guidelines be used to improve clinical practice?* Leeds: University of Leeds.

4. Davis, D. A. , Thomson, M. A. , Oxman, A. D. , et al. 1995. Changing physician performance: a systematic review of the effect of continuing medical education strategies. *JAMA*; 274:700-5.

5. Snell, J. L. , Buck, E. L. 1996. Increasing cancer screening: a meta analysis. *Prev Med* ; 25:702-7.

6. Mandelblatt, J. , Kanetsky. P. A. 1995. Effectiveness of interventions to enhance physician screening for breast cancer. *J Fam Pract* ; 40:162-71.

7. Buntinx, F. , Winkens, R. , Grol, R. et al. 1993. Influencing diagnostic and preventative performance in ambulatory care by feedback and reminders. A review. *Fam Pract* ; 10:219-28.

8. Thomson, M. A. , Ozman, A. D. , Davis, D. A. , Hayne, R. B. , Freemantle, N. , Harvey, E. L. 1999. Outreach visits to improve health professional practice and health care outcomes (Cochrane Review). In: *The Cochrane Library*, Issue 1, Oxford:Update Software.

Appendix 3 Necrotizing Fasciitis

1. Bisno, A. L. , Cockerill, F. R. , Bermudez. C. T. 2000. The initial outpatient Physician encounter in group A Streptococcal necrotizing fasciitis. *Clin Inf Diseases* 31, 607-8.

2. Wall, D. B. , de Virgilio, C. , Black, S. , Klein, S. R. 2000. The objective criteria may assist in distinguishing necrotizing fasciitis from necrotizing soft tissue infection. *The American Journal of Surgery* 179 (1), 17-21.

3. Simonart, T. et al. 2001. Value of standard laboratory test for the earlier recognition of group A Haemolytic Streptococcal necrotizing fasciilis. *Clin Inf Diseases* 32, e9-12.

4. Majeski, J. , Majeski, E. 1997. Necrotizing faciitis; improved survival with early recognition by tissue biopsy and aggressive surgical treatment. *Southern Medical Journal* 90 (11): 1065-8.

5. Stanenkovic, I. and Lew, P. D. 1984. Early recognition of potentially fatal necrotizing fasciitis (the use of frozen section biopsy). *The New England Journal of Medicine*, 310 (26) 1689-93.

6. Fink, S. , Chaudhuri, T. K. , Davis, H. H. 1999. Necrotizing faciitis and malpractice claims. *Southern Medical Journal 1992* (8) 770-774.

7. Brothers, T. E. , Tagge, D. U. , Stutley, J. E. et al. 1998. Magnetic resonance imaging differentiates between necrotizing and non-necrotizing fasciitis of the lower extremity. *J Am. Coll. Surg*. 187, 416-421.

ISBN 1-903982-12-X