

# The management of cellulitis and erysipelas at an academic emergency department: current practice versus the literature

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## Abstract

Cellulitis and erysipelas are common presentations to emergency departments and family physicians. Evidence-based guidelines for appropriate management of these infections exist in Canada, but inconsistent practices persist. Our objective was to determine the level of adherence to current evidence and guidelines by emergency physicians at the two hospitals in Kingston, Ontario, Canada. We identified all of the electronic medical records of patients who were seen at Kingston General Hospital or Hotel Dieu Hospital between January 1, 2015 and June 30, 2015 and given a diagnosis of cellulitis or erysipelas. We randomly selected 182 charts and conducted a retrospective chart review, manually collecting data for patient demographics, medical history, and medical management. Oral cephalixin alone was given to 44% of our sample, and it was the most common form of therapy for uncomplicated cellulitis. 36% of patients given any antibiotics at all received at least one dose of parenteral antibiotics, despite only 6.7% of these patients showing systemic signs of illness. 88% of those receiving parenteral antibiotics received ceftriaxone, a broad-spectrum, third generation cephalosporin. We found wide variation in antibiotic selection and route of administration for patients presenting to the emergency department with cellulitis or erysipelas. Overuse of antibiotics is common, and we believe the use of parenteral antibiotics may have been unnecessary for some patients in our sample. Emergency physicians should align their management plans more closely with the current guidelines to improve practice and reduce unnecessary administration of broad-spectrum parenteral antibiotics.

## Introduction

Visits for cellulitis and erysipelas represent a large proportion of cases seen by emergency physicians. Basic emergency department management consists of antibiotics and appropriate supportive care, determining if an admission to hospital is necessary, and arranging appropriate follow-up. Antibiotic therapy targeted against beta-hemolytic streptococci and *Staphylococcus aureus*, methicillin-sensitive or methicillin-resistant, is the mainstay of treatment for children and adults with these infections.<sup>1</sup> However, overall severity of illness and underlying comorbidities ultimately determine variables such as delivery route, dosage, frequency, and class of agent.<sup>2</sup>

Cephalexin, a first generation cephalosporin, is the preferred oral antibiotic for uncomplicated cellulitis without abscess.<sup>3</sup> Published indications for parenteral antibiotics in cellulitis include compromised oral administration, immunocompromise, and signs of systemic infection.<sup>2</sup> These guidelines are incorporated into recommendations for providers across Canada.<sup>4-6</sup> Outpatient parenteral antibiotic therapy (OPAT) is chosen for some patients, and has several advantages, namely as a cost-saving measure for the healthcare system, because patients avoid admission to hospital and repeat visits to the emergency department.<sup>7</sup> In this study, we describe the management practices of emergency physicians in Kingston, Ontario for patients diagnosed with cellulitis or erysipelas.

## Materials and Methods

### Study design and population

We conducted a retrospective chart review at Kingston General Hospital (KGH) and Hotel Dieu Hospital (HDH) in Kingston, Ontario, Canada. KGH is a tertiary care centre and HDH is an ambulatory urgent care centre. They are both teaching hospitals and serve about 500,000 residents in southeastern Ontario. A team of emergency physicians staff both the KGH emergency department and the HDH urgent care centre and see approximately 100,000 patients per year. Ethics approval was obtained from the Queen's University Health Sciences Research Ethics Board.

### Data collection

We identified all of the charts from the electronic medical record (EMR) for the 6-month period between January 1, 2015 and June 30, 2015 for patients with a discharge diagnosis of cellulitis or erysipelas. We ran-

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domly selected a subset of these charts for data collection, but excluded charts if they were inaccessible or did not contain usable data, patients were not seen by an emergency physician, patients were younger than 1 year old, or there was a suspected diagnosis of preseptal or orbital cellulitis.

Patient data were manually collected for vital signs at time of triage, and patient factors or comorbidities that may increase the risk of complications of cellulitis and erysipelas or may predispose to community-acquired MRSA infection. The comorbidities and patient factors we included were known diabetes, active cancer treatment, documented cancer diagnosis within 6 months, history of organ transplant, intravenous drug use, or residence in an assisted living environment or shelter. We determined whether antibiotics were given; the dose and route of the antibiotics (parenteral, topical, oral); whether they were admitted

or discharged home with follow up; duration and length of time until route switch, where applicable; as well as any explicit reasoning behind the choice of treatment. We also tracked who returned to the emergency department within two weeks of initial presentation for worsening disease, adverse events related to treatment; and whether there were any complications related to treatment, such as allergic reactions.

### Data analysis

Data were analysed using descriptive statistics. Data abstraction and analysis were done using Microsoft Excel.

## Results

### Patients' characteristics

There were 707 visits to KGH and HDH for cellulitis or erysipelas between January 2015 and June 2015. We randomly selected 182 of these charts for study, 178 of which were for patients diagnosed with cellulitis and four of which were for patients with erysipelas. Patient characteristics for our sample population are presented in Table 1. Four charts selected in the process were for return visits to the emergency department for worsening disease or complications, or for scheduled reassessment. We collected data from these records but also from the patient's initial presentation for the infection.

### Management plans

In 16 of 182 visits, patients received no antibiotics (Table 1; Figure 1). One of these patients was a 63-year-old man with normal vital signs who had an incision and drainage performed for an abscess at his initial visit, but returned the next day with cellulitis. This man had normal vital signs at his return visit and received two doses of intravenous ceftriaxone 24 hours apart before starting a course of cephalexin. The remaining fifteen patients did not return to the emergency department within the following two weeks. 106 patients received oral antibiotics only or were advised to continue existing courses of oral antibiotics (Table 1; Figure 1). Although cephalexin was the sole agent prescribed in 72 of those cases, seven patients received combinations with trimethoprim/sulfamethoxazole (n=1), ciprofloxacin (n=2), doxycycline (n=1), or metronidazole (n=3). In those not receiving any cephalexin initially, initial agents were clindamycin (n=7), trimethoprim/sulfamethoxazole (n=4), ciprofloxacin (n=3), amoxicillin-clavulanate (n=1; for a cat bite victim), or doxycycline (n=4; for suspected early localized Lyme disease), or combina-

tions thereof (n=5). Three patients were noted to be discharged with oral antibiotics, but no specific details were available. Thirteen of those given only oral antibiotics returned to the emergency department for a scheduled recheck or to request reassessment. Six of these patients continued their existing course of management, but six others received parenteral antibiotics, and one patient started ciprofloxacin and metronidazole but was eventually admitted after further return visits.

Greater than one third of the patients given any antibiotics at their first visit (60 of 166) received empiric parenteral therapy for cellulitis, then were switched to or augmented with oral antibiotics if improvement was observed. 88% (53 of 60) received ceftriaxone, some augmented with vancomycin (n=3) or metronidazole (n=2), and the remaining patients received ceftazidime (n=5 [one patient received both ceftazidime and ceftazidime]), clindamycin (n=1), cefazidime (n=1), or an unknown parenteral antibiotic (n=1) (Figure 1). One patient given parenteral antibiotics during their initial visit was also admitted. Four of the 60 patients (6.7%) exhibited tachycardia or fever at triage. Six patients were sent home with supports set up to administer OPAT, although one was subsequently admitted.

Of the 55 patients with one or more comorbidities as listed above, all received antibiotics. 44% (24 of 55) received cephalexin only. Clindamycin, trimetho-

prim/sulfamethoxazole, and metronidazole were used alone or in combination with a cephalosporin in 22% (12 of 55) of cases, but explicit reasoning was not recorded in most of the charts (Figure 2).

Emergency physicians used a variety of antibiotic classes, combinations, and routes of administration (Table 2). Four patients were noted to have allergies to penicillin or cephalexin, but clinical reasoning for antibiotic choice and acknowledgment of the presence of allergies was otherwise absent in the documentation.

There were 62 return visits to the emergency department within 2 weeks of discharge from emergency. This number included 46 who returned for scheduled rechecks, repeat doses of IV antibiotics; or addition of IV antibiotics to the management plan, due to worsening infection (n=3). Nine patients were admitted upon returning for rechecks. Of the remaining visits, one patient returned with anaphylaxis, possibly secondary to the cephalexin or doxycycline prescribed; a second patient returned with a possible drug rash after receiving two intravenous doses of ceftriaxone and oral trimethoprim/sulfamethoxazole; and a third patient needed an indwelling IV line removed and reinserted. The other return visits by patients to the emergency department (n=13) were for separate reasons unrelated to the initial diagnosis.

**Table 1. Patients' characteristics.**

Characteristics	N = 182
Median age (range), years	49 (2-94)
Sex, male/female, n (%)	103 (57) / 79 (43)
Institution visited	
KGH	66 (36)
HDH	116 (64)
Vital signs at triage	
Fever*, n (%)	6 (3)
Tachycardia <sup>o</sup> , n (%)	30 (16)
Comorbidities	
Diabetes, type I or II, n (%)	31 (17)
End-stage renal disease, n (%)	3 (2)
Organ transplant <sup>†</sup> , n (%)	1 (0.5)
Concurrent malignancy, n (%)	6 (3)
HIV/AIDS, n (%)	1 (0.5)
Intravenous drug use, n (%)	13 (7)
Living in assisted environment or shelter, n (%)	10 (5)
History of MRSA infection, n (%)	5 (3)
Initial antibiotic therapy administered	
No antibiotics, n (%)	16 (9)
Oral antibiotics only, n (%)	106 (58)
Empiric parenteral antibiotics, n (%)	60 (33)

\*Oral temperature >38.0°C, <sup>o</sup>heart rate greater than 160 beats per minute (bpm) for infants (<2 years), greater than 140 bpm; for children (2 to 12 years), and greater than 100 bpm for adolescents and adults; <sup>†</sup>the only patient with an organ transplant had had a renal transplant.

## Discussion

Cellulitis and erysipelas are common reasons for emergency department and urgent care visits in our population. In fact, within our study period of six months, we identified over 700 visits related to the skin infections. Outpatient management with self-administration of oral cephalexin was the most common choice of management for cellulitis and erysipelas. This is the recommended antibiotic for uncomplicated cellulitis considering its spectrum of activity.<sup>2,3</sup> We note more than one third of the patients in our study given any antibiotics were initially treated with empiric parenteral therapy for cellulitis then switched to or continued on oral antibiotics if improvement was noted after 48 to 72 hours. However, almost all of these patients were systemically well at the time of their triage assessment. Canadian expert guidelines dictate conservative management with oral medication, with the addition of parenteral medication if there are signs of worsening disease despite two or more days of oral therapy.<sup>4,5</sup>

Skin infections are largely clinical diagnoses, and in the absence of systemic signs of illness, clinical improvement in cellulitis and erysipelas should be monitored during the 48 to 72 hour period after initiation of treatment. Of those patients in our study population who returned to the emergency department reassessment after starting an oral agent, just less than half received parenteral antibiotics despite normal vital signs. It is difficult for us to comment on whether parenteral antibiotics were given for worsening clinical appearance because of limited detail in charting. However, in the absence of abnormal vital signs and given the erythema and edema of cellulitis may worsen in the first 24 to 48 hours of treatment,<sup>4,7</sup> we question whether a switch to or augmentation with parenteral antibiotics was necessary in all cases.

Overuse of parenteral antibiotics is very common,<sup>8</sup> but a recent Cochrane review suggests oral antibiotics (macrolides/streptogramins) may be more effective for cellulitis and erysipelas than penicillin given parenterally and recommends further study on this subject.<sup>9</sup> We must assume physicians seeing patients included in our study chose parenteral administration based on gross appearance of the cellulitis possibly in combination with other patient factors, such as poor reliability. Such extenuating patient factors, if present, were not described in the chart records, so we cannot accurately analyse decision-making. Management of these infections should vary depending on the presence of chronic illnesses and signs of

systemic involvement to minimize treatment failure.<sup>10</sup> However, there should not be overreliance on parenteral therapy when there is no evidence of improved efficacy.

Overuse of antibiotics in general, though not a focus of this study, has other risks. Two patients returned after suspected allergic response to antibiotics, including one with anaphylaxis. Allergic reaction to antibiotics is not uncommon<sup>11</sup> and it reinforces the importance of justification for antibiotics whenever they are prescribed.

There is no widely used infection severity scale in Canada but evidence-based sources do exist to help inform treatment plans.<sup>12</sup> We found substantial variation among emergency physicians in management of cellulitis and erysipelas. This mir-

rors a previous review of emergency department management of cellulitis in the province of Alberta, Canada.<sup>13</sup> However, they describe a significantly higher use of intravenous cefazolin (47% of initial treatment regimens) versus oral cephalexin (8% of initial treatment regimens). In our data set, oral cephalexin was given in 44% of the initial treatment plans versus intravenous cefazolin in only 2.7% of the initial treatment plans. Ceftriaxone, a broad-spectrum third generation cephalosporin with good coverage of Gram-negative bacteria but less activity against Gram-positive bacteria than earlier generation cephalosporins, was the most frequently used parenteral antibiotic in our study. Current guidelines reserve ceftriaxone for severe, deep infections involving

**Table 2. Type/route of antibiotics received for cellulitis/erysipelas at the initial visit to the emergency department.**

Type	Number (% of 182 total)
Cephalexin PO	80 (44.0)
Ceftriaxone IV, cephalexin PO	30 (16.5)
Clindamycin PO	6 (3.3)
Ceftriaxone IV/IM	4 (2.2)
Ceftriaxone IV, Septra PO	4 (2.2)
Ciprofloxacin PO	4 (2.2)
Septra PO	3 (1.6)
Cefazolin IV	3 (1.6)
Ceftriaxone IV, clavulin PO	3 (1.6)
Cephalexin PO and septra PO	2 (1.1)
Cephalexin PO, doxycycline PO	2 (1.1)
Amoxicillin PO	2 (1.1)
Clarithromycin PO	2 (1.1)
Ceftriaxone IV, vancomycin IV, septra PO	2 (1.1)
Cefazolin IV, Cephalexin PO	2 (1.1)
Clindamycin IV, Clindamycin PO	1 (0.5)
Ciprofloxacin PO, Clindamycin PO	1 (0.5)
Amoxicillin-clavulinate PO	1 (0.5)
Doxycycline PO and metronidazole PO	1 (0.5)
Cephalexin PO and metronidazole PO	1 (0.5)
Ceftriaxone IV, Cloxacillin PO	1 (0.5)
Ceftriaxone IV, Cefazolin IV, Cephalexin PO	1 (0.5)
Ceftriaxone IV, Metronidazole IV, Cephalexin PO	1 (0.5)
Ceftriaxone IV, cephalexin PO, valacyclovir PO	1 (0.5)
Ceftriaxone IV, vancomycin IV	1 (0.5)
Ceftriaxone IV, Penicillin V PO	1 (0.5)
Doxycycline PO	1 (0.5)
Ceftazidime IV, Cefprozil PO	1 (0.5)
Vancomycin IV	1 (0.5)
Ceftriaxone IM, Cephalexin PO, Ciprofloxacin PO	1 (0.5)
Ceftriaxone IV, Cephalexin PO, fluconazole PO	1 (0.5)
Unknown antibiotic IV, Cephalexin PO	1 (0.5)
No antibiotics	16 (8.8)

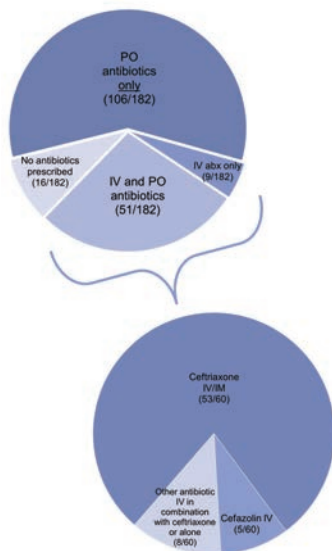
other tissues and organs; and promote cefazolin intravenously for mild, moderate, or severe cellulitis.<sup>2,4,6</sup> However, some advocate for ceftriaxone given its smaller side effect profile and ease of administration.<sup>7</sup> In the United Kingdom, the narrow-spectrum penicillin flucloxacillin, which is available orally or intravenously, is suggested ahead of broader-spectrum agents.<sup>14</sup> Regarding OPAT and return visits to the emergency department for repeat parenteral dosing, ceftriaxone may be more sensible given its once daily administration. However, once-daily cefazolin in combination with oral probenecid is equivalent to ceftriaxone in treating moderate/severe cellulitis.<sup>15</sup>

A significant limitation to managing cellulitis effectively is the lack of standardized scales of disease severity. No consistent explicit reasoning for choice of management plan was demonstrated in the charting by emergency physicians analysed in this study, and it was not apparent whether physicians were using any grading system or algorithm. The majority of patients were systemically well according to vital signs taken by the triage nurse, and physicians' notes demonstrated a lack of subjective constitutional symptoms in the majority of cases when details were documented. Some Canadian centres have developed their own guidelines, including the

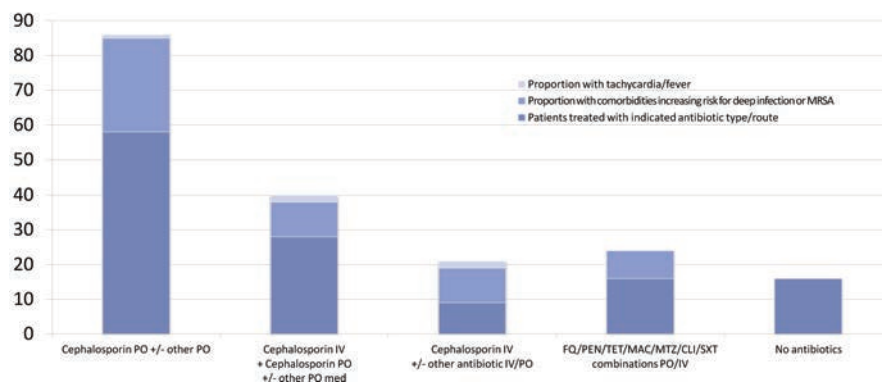
Nova Scotia Adult Cellulitis Guidelines, developed in 2000 and validated in subsequent studies;<sup>6</sup> Toronto's University Health Network;<sup>4</sup> and Providence Health Care in British Columbia.<sup>5</sup> The guidelines are largely consistent with each other, as well as with other international guidelines,<sup>2,12,14</sup> and accurately reflect published evidence in the infectious disease literature. In the present study, we were unable to determine if emergency physicians adhered to any of these rules, and documentation in the EMR would suggest they were not. Limitations to this study include the small sample size. We used random sampling to collect 182 charts for this chart review, because our aim was to capture a snapshot of antibiotic use in our sample population. Future studies could make use of systematic sampling to allow for a larger, more representative sample over the course of years rather than several months. Additionally, we were limited by the amount of information documented. Charting by emergency physicians was brief, as is customary; and pertinent features, such as appearance of the region of cellulitis or details about risk factors common in this part of the province such as intravenous drug use, were often not recorded. We do note that physicians sometimes used templates for information gathering, but even in those cases, recording of risk factors such as intravenous drug use was frequently incomplete.

## Conclusions

Our study has found a wide variety in the antibiotic selection and route of administration for the treatment of cellulitis and erysipelas in patients presenting to two tertiary care emergency departments in the province of Ontario. Outpatient administration of oral cephalexin is the predominant form of therapy for cellulitis and erysipelas and this is consistent with management guidelines. However, a significant number of patients received parenteral broad-spectrum antibiotics and continued on this as outpatients, returning to the emergency department for repeat dosing. This would contribute considerable cost in terms of money, time, and resources to an already busy emergency medicine system. It may be easier and more economically feasible to administer a once daily broad-spectrum antibiotic, like ceftriaxone. However, we question whether it should be at the expense of existing evidence when we know the most likely culprit organism, and when newer antimicrobials have near-equivalent intravenous and oral bioavailability. The prevalence of antibiotic resistance is increasing and evidence-based prescribing and more appropriate antibiotic usage should become increasingly important.



**Figure 1. Proportions of patients by route of antibiotic administration. The majority of patients receiving parenteral antibiotic were given ceftriaxone. The other antibiotics given were given vancomycin, metronidazole, or ceftazidime. Of those given any intravenous antibiotic, 6.7% had tachycardia and fever.**



**Figure 2. Numbers of patients by antibiotic regimen received and comorbidities. A wide variety of antibiotics were chosen for initial management of patients with cellulitis. Little consistency was seen with respect to comorbidities. FQ, fluoroquinolones; PEN, penicillins; TET, tetracyclines; MAC, macrolides; MTZ, metronidazole; CLI, clindamycin; SXT, trimethoprim/sulfamethoxazole.**

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