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Emergency department management of home intravenous antibiotic therapy for cellulitis

M Donald, N Marlow, E Swinburn, M Wu

Objective: To evaluate the safety and efficacy of using intravenous cephazolin as a first line antibiotic for the treatment of cellulitis in a supervised outpatient programme.

Methods: This study was a retrospective analysis and included all patients who attended the emergency department (ED) of a university affiliated hospital in Sydney over the period of 1 year and who satisfied the following inclusion criteria: (a) age >16 years, (b) presented with acute cellulitis, and (c) were suitable for home intravenous antibiotic therapy according to APAC guidelines.

Results: In total, 124 patients were included, of whom 53 (42.7%) presented directly to the ED and 71 (57.3%) were referred by their general practitioner. Of these 124 patients, 75 (60.5%) were men and 49 (39.5%) were women. Age range was 16–97 years. There were 82 (66.2%) presentations of cellulitis of the lower limb, 30 (24.2%) of the upper limb, 9 (7.2%) of the face and 3 (2.4%) of the torso. Cephazolin 2 g twice daily was given to 123 (99.2%) of the patients, and one patient (0.8%) received ceftriaxone 2 g once daily. In total, 105 patients (84.7%) were treated successfully and 19 (15.3%) were re-admitted. Four of the unsuccessful treatment group required incision and drainage of abscesses. The mean duration of intravenous therapy was 6.24 days. One patient developed diarrhoea. There were no other complications attributable to therapy.

Conclusion: Low re-admission rates verify the efficacy of cephazolin 2 g twice daily in treating cellulitis in the home environment. Benefits are multiple and include economic savings and reduced risk of nosocomial infection.

Cellulitis is a common problem in patients presenting to the emergency department (ED). Patients who are diagnosed with cellulitis that is severe enough to require intravenous antibiotics have traditionally required admission to hospital for treatment. The past 10 years has seen the evolution of hospital in the home (HIH) or outpatient parenteral antibiotic therapy, which has been shown to be safe, effective, and cost effective, with reports of high patient satisfaction.

Northern Sydney Health delivers HIH via Acute/Post Acute Care (APAC) Services, a body originally set up in 2000 for the purposes of providing an alternative treatment strategy for patients who would have traditionally been treated in hospital. This is achieved by a 7 days/week, 365 days/year, multidisciplinary service comprising registered nurses, occupational therapists, physiotherapists, pharmacists, and community care aides, which services five Sydney hospitals with a population base of 780 000.

When a patient is identified as having clinical inflammation of the tissues, the senior doctor in the ED is consulted as to whether to activate the APAC clinical pathway for treatment of cellulitis as an outpatient.

APAC operates under strict clinical guidelines when considering patients for home intravenous antibiotic therapy for cellulitis (table 1). These guidelines have been agreed with consultation between Northern Sydney Area Health infectious diseases and medical microbiology departments. Once a referral has been made to APAC, the patient is visited in the ED by a nurse who admits the patient onto the programme. At this stage, APAC can provide links to other support services within the multidisciplinary team. An intravenous cannula is sited and left in situ and arrangements are made to visit the patient at home to administer the intravenous therapy. The first dose of antibiotic is administered in the ED. The patient is visited, usually twice daily at home, and the nurse performs vital signs (heart rate, blood pressure, and temperature), and monitors the response of the cellulitis to treatment before administering antibiotics. The cannula site is inspected daily and the cannula is changed every 72 hours or more frequently if required. Arrangements are made to review the patient in ED by the senior doctor at an agreed time and decisions to continue or discontinue treatment are made at these review appointments. If at any stage, the patient is thought to be becoming systemically unwell or not responding, the APAC nurse can refer directly to the ED for urgent review.

The aims of this study were to evaluate the safety and efficacy of using intravenous cephazolin as a first line antibiotic treatment for the treatment of cellulitis in a supervised outpatient programme.

Methods

This retrospective analysis was conducted jointly with the Emergency Department of Mona Vale Hospital and APAC. Mona Vale is a university affiliated hospital in Sydney, Australia, with an annual attendance rate of 22 000.

All patients over the age of 16 years with a primary diagnosis of acute cellulitis—that is, inflammation of the soft tissues secondary to a presumed bacterial infection, who were deemed suitable for intravenous antibiotics as outpatients by the APAC criteria were included. This decision was made by the senior ED doctor and if there was any doubt as to suitability, the patient was discussed with the microbiology consultant. The period examined was 12 months (July 2002–June 2003). Patients were identified using the ED database.

Abbreviations: APAC, Acute/Post Acute Care; ED, emergency department; HIH, hospital in the home
RESULTS

For the study, 124 patients were identified. Age range was 16–97 years. In total, 53 (42.7%) presented directly to the ED and 71 (57.3%) were referred by their general practitioner. Of the 124 patients, 75 (60.5%) were men and 49 (39.5%) were women. Cellulitis of the lower limb was presented by 82 patients (66.2%), while 30 (24.2%) presented cellulitis of the upper limb, 9 (7.2%) of the face and 3 (2.4%) of the torso (fig 1). Treatment with cephazolin was given to 123 patients (99.2%), and the remaining patient (0.8%) received ceftriaxone.

In total, 105 (84.7%) patients were treated successfully and 19 (15.3%) were re-admitted (fig 2). Reasons for re-admission included failure of the cellulitis to resolve in 13 of the patients. Four patients developed abscesses that required surgical intervention. This group of patients were recognised early and re-admitted as planned admissions. One patient required admission for analgesia and another required admission for central venous access as no peripheral access was available (table 1).

The mean duration of intravenous therapy was 6.24 days. One patient developed diarrhoea that was self-limiting. There were no other complications attributable to therapy.

DISCUSSION

Despite the evolution of outpatient intravenous antibiotic therapy worldwide, there have been continuing concerns about its safety. There is still a general lack of published data regarding outcomes from this type of therapy and until this is reversed, the treatment will remain controversial.

This retrospective review provides more data to show that using intravenous cephazolin as a first line antibiotic in cellulitis via a supervised outpatient programme is safe and efficacious. The majority of patients responded (84.7%) and there was only one complication attributable to therapy.

Cellulitis is a common presentation to the ED and if these patients are all admitted and treated with flucloxacillin six hourly, a significant number of bed days are used. Other than cost and bed days saved, the other benefits of outpatient therapy are: (a) patients are happier in their own home and can sleep, eat, and toilet in comfort; (b) patients mobilise and therefore are at lower risk of developing deep venous thrombosis; (c) once hospitalised, many patients are commenced on prophylactic low molecular weight heparin, which also has risks; (d) there is less risk of nosocomial infection (it is important to give consideration to community based resistance developing).

In a study in Scotland, skin and soft tissue infections accounted for 10% of hospitalisations, with mean stays of approximately 5 days, and were the second most common reason for hospital based intravenous antibiotic therapy lasting more than 48 hours. This group of patients represents a significant number of presentations to the ED and consumes considerable treatment resources. There are currently many different ways of treating cellulitis, which are often dependent on the patient’s country. Cephazolin was chosen for this study because at present it has low resistance rates and is active against Group A beta-haemolytic streptococci, which are the organisms most commonly implicated in cellulitis. Cephazolin attains high serum levels and is excreted quickly via the

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**Table 1** APAC exclusion criteria

<table>
<thead>
<tr>
<th>Age &lt; 16 years</th>
<th>Cellulitis that originated from a suspected bite or water injury</th>
<th>Bone or joint involvement considered likely</th>
<th>Confusion or syncope</th>
<th>Vomiting more than once in the previous 12 hours</th>
<th>White cell count &lt; 4.0 or &gt; 20 x 10^9/l</th>
<th>Biochemical evidence of severe systemic illness</th>
<th>Blood glucose &gt; 15 mmol/l</th>
<th>Creatinine &gt; 1.5 times normal level</th>
<th>Albumin aminotransferase &gt; 200 IU/l</th>
</tr>
</thead>
</table>

*Water injury: n injury/wound sustained while in contact with fresh or salt water, which may result in infection with organisms that are not sensitive to cephazolin.

**Table 2** reasons for patient re-admission

<table>
<thead>
<tr>
<th>Sex</th>
<th>Age (years)</th>
<th>Site of cellulitis</th>
<th>Reason for re-admission</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>49</td>
<td>Lower limb</td>
<td>Failure of cellulitis to resolve</td>
</tr>
<tr>
<td>M</td>
<td>75</td>
<td>Lower limb</td>
<td>Failure of cellulitis to resolve</td>
</tr>
<tr>
<td>M</td>
<td>36</td>
<td>Lower limb</td>
<td>Failure of cellulitis to resolve</td>
</tr>
<tr>
<td>M</td>
<td>78</td>
<td>Lower limb</td>
<td>Failure of cellulitis to resolve</td>
</tr>
<tr>
<td>F</td>
<td>70</td>
<td>Torso</td>
<td>Failure of cellulitis to resolve</td>
</tr>
<tr>
<td>M</td>
<td>33</td>
<td>Lower limb</td>
<td>Failure of cellulitis to resolve</td>
</tr>
<tr>
<td>M</td>
<td>77</td>
<td>Lower limb</td>
<td>Failure of cellulitis to resolve</td>
</tr>
<tr>
<td>M</td>
<td>36</td>
<td>Upper limb</td>
<td>Failure of cellulitis to resolve</td>
</tr>
<tr>
<td>M</td>
<td>52</td>
<td>Upper limb</td>
<td>Failure of cellulitis to resolve</td>
</tr>
<tr>
<td>F</td>
<td>79</td>
<td>Lower limb</td>
<td>Failure of cellulitis to resolve</td>
</tr>
<tr>
<td>F</td>
<td>63</td>
<td>Lower limb</td>
<td>Failure of cellulitis to resolve</td>
</tr>
<tr>
<td>F</td>
<td>42</td>
<td>Upper limb</td>
<td>Failure of cellulitis to resolve</td>
</tr>
<tr>
<td>M</td>
<td>29</td>
<td>Face</td>
<td>Failure of cellulitis to resolve</td>
</tr>
<tr>
<td>M</td>
<td>52</td>
<td>Lower limb</td>
<td>Incision and drainage abscess</td>
</tr>
<tr>
<td>F</td>
<td>43</td>
<td>Upper limb</td>
<td>Incision and drainage abscess</td>
</tr>
<tr>
<td>M</td>
<td>34</td>
<td>Lower limb</td>
<td>Incision and drainage abscess</td>
</tr>
<tr>
<td>M</td>
<td>23</td>
<td>Lower limb</td>
<td>Incision and drainage abscess</td>
</tr>
<tr>
<td>F</td>
<td>78</td>
<td>Lower limb</td>
<td>Analgesia</td>
</tr>
<tr>
<td>F</td>
<td>51</td>
<td>Upper limb</td>
<td>Central venous access required</td>
</tr>
</tbody>
</table>

Figure 1 (A) Anatomical distribution of cellulitis.

Figure 2 Number of successful treatments.
kidneys. Another important reason for utilising cephazolin is that it is a twice daily dose which makes it much more feasible to use in the outpatient setting.

A review of the epidemiology of cellulitis of five Canadian urban EDs revealed that most cases were treated with intravenous cephazolin (58%) as outpatients; however, over 25 different antibiotics and doses were initially prescribed, and the study concluded that there was a need to develop practice guidelines for this common ED problem, given the considerable practice variation.

Our study reflects a strict adherence to guidelines recommending intravenous cephazolin as a first line treatment for cellulitis, with all but one patient receiving it. Another option being considered is a combination of cephazolin and probenecid, but only for a select group of patients. Studies have indicated that once daily cephazolin in combination with probenecid is equivalent to once daily ceftriaxone plus oral placebo for the treatment of moderate to severe cellulitis.

The issue of safety of intravenous therapy in the outpatient setting is a recurring theme in the literature. A randomised control trial by Caplan et al concluded that hospital in the home treatment provided a safe alternative to hospitalisation for a selected group of patients, a finding validated further by Montalto, who concluded that hospital in the home care was very safe. The key to operating a successful HIH service lies with patient selection and following rigorous protocols that are regularly updated.

As HIH becomes more popular, it will become easier to compile outcome based registries for validation purposes and provision of further evidence of its efficacy and cost effectiveness. Full cost benefit analysis will give a categorical answer as to exactly how much money can be saved.

We hope that our study will provide further evidence that HIH is a safe and effective treatment option for patients with cellulitis that can be co-ordinated within the setting of the ED.

Authors’ affiliations
M Donald, E Swinburn, Royal North Shore Hospital, Sydney, Australia
N Marlow, Northern Sydney Health, Sydney, Australia
M Wu, Mona Vale Hospital, Australia

Competing interests: N Marlow is area manager for APAC Services, Northern Sydney Health.

REFERENCES