

Primary options for acute care:

Cellulitis management in Counties Manukau DHB

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ABSTRACT

Primary Options for Acute Care (POAC) is a primary care funded service that encourages and funds primary care physicians to care for people in the community who may otherwise be admitted to hospital. An example of this is the treatment of cellulitis with intravenous antibiotics in the community rather than admission to hospital. As access to this opportunity is relatively new, there is a need for guidance. This paper describes the effect on admission rate and cost of implementing guidelines for the care of people with cellulitis by primary care physicians rather than admission to hospital.

Key words

Cellulitis, primary care, intravenous antibiotics

Introduction

Primary Options for Acute Care (POAC) is a primary care driven service that enables primary care physicians' access to investigations, care and treatment for their patients to prevent hospital admission and manage them safely in the community. The primary care physician may 'purchase' up to \$300.00 worth of treatment to maintain a person in the community rather than admit them to hospital.

This service was piloted in February 2001 and, following its success,

rolled out to all primary care physicians caring for patients in the Counties Manukau DHB area who would otherwise be referred to hospital during an acute illness/event. An important potential area for treatment in primary care is home-based intravenous (IV) antibiotics. Howden et al.¹ reviewed home IV antibiotic therapy in Australia. It was considered that administration of home IV antibiotics was possible through once daily aminoglycosides (pyelonephritis), continuous-infusion β -lactams (flucloxacillin), once or twice daily

This paper by Gina Barker, Linda Bryant and Harley Aish is the first to be published in this new section of the journal dedicated to publishing reports on initiatives that have improved performance in primary care (see comment in the editorial in this issue). We are aware that most general practices in New Zealand are involved in quality improvement programmes and also that the outcomes of this huge effort are seldom published. We welcome contributions (up to 2,500 words) from primary care that might assist other general practices to change their performance to improve the care that they offer their patients. Please follow the Instructions to Authors in the journal or on the NZFP website (<http://www.rnzcgp.org.nz/news/nzfp.php>) and email your manuscript to the editor as a Word or .rtf attachment (tonytownsend@xtra.co.nz).

cephalosporins (cephazolin) and oral fluoroquinolones (e.g. ciprofloxacin).

The potential strengths of home IV antibiotics included:

1. The patient being at home with family and able to continue work/school;
2. A sense of empowerment for the patient;
3. Fewer nosocomial and cannula-associated infections.

To balance this some potential challenges included:

1. Disruption to family routine;
2. A sense of abandonment;
3. Inappropriate antibiotic selection based on convenience perhaps;
4. Non-compliance with bed rest, leg elevation etc.

In evaluating the referral types to POAC following the pilot, it was noted that along with respiratory conditions, cellulitis was a major reason for referral to the service. On further investigation it became evident that there were many variations in cellulitis IV treatment in primary care, some of which were difficult regimens to manage both time- and cost-wise.

Following the principle that 'Antibiotic selection should be based on appropriate prescribing principles rather than purely dosing convenience',¹ POAC formed a working party to identify clinical guidelines in treating cellulitis that would reflect consistent best practice and be suitable in a primary care environment.

It was acknowledged that flucloxacillin 1–2gm qid intravenously was the gold standard in treating but, due to its impracticalities and high resource cost, an alternative regimen was sought that was more convenient but would not compromise the standard of care.

A study by Christchurch Hospital physicians² reviewed the results of home IV antibiotics in Christchurch over a 12 month period, but offered few comments on the practicalities and organisation of the service, other than it was hospital initiated and based.

Of 153 people admitted into the service, 43 had cellulitis. Of the total people in the service 13% had peni-

cillin, 56% flucloxacillin, 29% cephazolin, 10% ceftriaxone.

From POAC's perspective, the major limitation was the number of central lines required; 129 had PICC lines (peripherally inserted central catheters), 15 had midlines, eight had peripheral angiocaths, one had a portacath.

Alternatives to flucloxacillin IV qid include:

A. Use of flucloxacillin IV tds + 4th dose oral, or flucloxacillin IV tds plus probenecid

The limited information in the literature relating to the use of flucloxacillin and probenecid in cellulitis or soft tissue infections involved the use of oral flucloxacillin.^{3,4} Flucloxacillin 1gm tds and flucloxacillin 1gm bd + probenecid 1gm bd resulted in similar peak serum concentrations of flucloxacillin.³ For flucloxacillin 1gm bd + probenecid the flucloxacillin serum concentration was >MIC for only 11 of the 24 hours.³ For flucloxacillin 1gm tds (without probenecid) the serum concentration was greater than the MIC for only ~ 4 hours post dose.⁴ For our guidelines it was considered that if cellulitis is severe enough to warrant IV antibiotics, then the evidence had to be stronger than extrapolation from oral therapy.

B. Use of flucloxacillin by continuous infusion

While there is evidence in the literature for the effectiveness of continuous flucloxacillin infusion⁵ it usually requires some form of central line (PICC or midline etc.) and the use of a pump or infusion device. This would be neither practical nor cost-effective in primary care, particularly for short-term antibiotic courses.

C. Use of a first generation cephalosporin (cephazolin) + probenecid

This regimen appeared to be the most appropriate method for providing IV antibiotic therapy in the home for people with cellulitis. The potential issue was with dosing. Once daily or

twice daily cephazolin had been considered in three studies.

Leder et al.,⁶ in a non-comparative study, used cephazolin 2gm IV bd for 57 people with cellulitis (61 episodes). There were 54 (89%) cures, one (1%) improvement, three (5%) failures and three (5%) indeterminants. Serum trough concentrations were done and it was noted that the mean concentration was above the MIC₉₀ for cephazolin. However patient variation meant that 0–11% of people may have trough serum concentrations below 0.4µg/ml, the MIC₉₀ for *Staphylococcal aureus*.

Brown et al.⁷ compared ceftriaxone IV 2gm daily, and cephazolin IV 2gm daily + probenecid 1gm daily. The treatment failure rate of 8% with cephazolin + probenecid was not significantly different to the failure rate with the ceftriaxone regimen.

Grayson et al.⁸ undertook a similar study in 2002 and found an 86% clinical cure rate at the end of treatment with cephazolin IV 2gm daily + probenecid 1gm daily. This was not significantly different to the ceftriaxone group. Mean trough cephazolin concentrations were 2.35µg/ml.

The recommendations for the treatment of cellulitis with IV antibiotics in the home by Howden et al.¹ were:

1. Cephazolin 2gm IV bd *or* cephazolin 2gm IV once daily + probenecid 1gm daily po
2. Alternative – flucloxacillin 8gm IV daily by continuous infusion.

Two hundred people presenting to Christchurch Hospital Emergency Department with cellulitis thought to require intravenous antibiotics were randomised to either inpatient treatment or treatment at home with cephazolin 2g intravenously twice daily. There was no significant difference between inpatient care and home treatment for clinical outcomes or quality of life (physical functioning or pain), and patient satisfaction was greater with home treatment. Eleven of the 101 home treatment people (12%) required transfer to hospital.⁹

It was decided that for the Counties Manukau DHB guidelines

Cephazolin 2gm IV daily + probenecid 500mg orally twice daily would be the alternative to flucloxacillin IV 2gm qid for the treatment of cellulitis in the community. Cephazolin was selected as the antibiotic because of its narrower, but suitable spectrum of action, and the desire to avoid use of third generation cephalosporins in the community because of concerns regarding bacterial resistance.

Cellulitis Kits were developed and prepared for POAC and included all material required to administer the IV treatment and included the oral probenecid. These were readily available for use to all Counties Manukau DHB general practices and after hours clinics.

Two years following the implementation of the guidelines and in line with continuous quality improvement a review of cellulitis referrals to POAC was undertaken.

Aim

The aim of this review was to identify the IV antibiotic management and admission rates of patients treated for cellulitis in primary care for Counties Manukau DHB. Data pre-implementation of the March 2003 guidelines was compared with data for March 2003 to March 2005.

Method

We obtained referral data for the period July 2002 to March 2005 and analysed this data for:

1. Referral rates to POAC for cellulitis;
2. Admission rates pre and post guideline implementation;
3. Compliance with guidelines for intravenous therapy;
4. Clinical cost.

The results

Referral numbers

Referrals to POAC for cellulitis have increased by 25% from July 2002 and March 2005, averaging 51.5 referrals per month between March 2004 and March 2005 (Figure 1). Since the advent of POAC, 11% of people treated

Figure 1. Referral rate to POAC for people with cellulitis

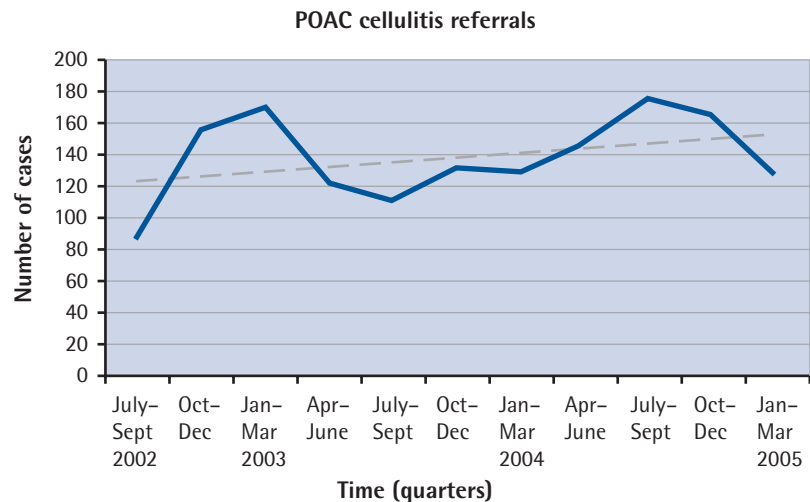
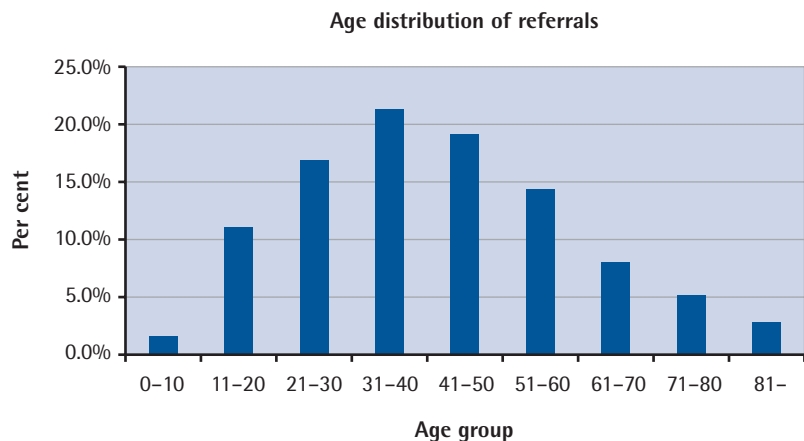


Figure 2. Age distribution of referrals for cellulitis



for cellulitis under POAC have been admitted to hospital.

POAC has implemented clinical governance systems through a clinical oversight board that consists of three primary care physicians and one secondary care physician from emergency care. This board is accountable for continuously improving the quality of the service and ensuring that all claims submitted are appropriate and eligible. Between the period July 2002 and March 2005, 99% of all referrals submitted have been deemed eligible and appropriate by the board.

The majority of referrals were aged between 30 and 50 years, with 22% of the total referrals aged between 31 and 40 years (Figure 2).

The site of infection predominantly involved the legs, with the arms being the second most common site (Figure 3).

Other findings noted that the predominant cause of cellulitis was a result of abscess or boil and 9.1% of all referrals had diabetes documented as a co-morbidity or contributing cause to the cellulitis. This however may not have been documented in all diabetic cases.

Antibiotic use

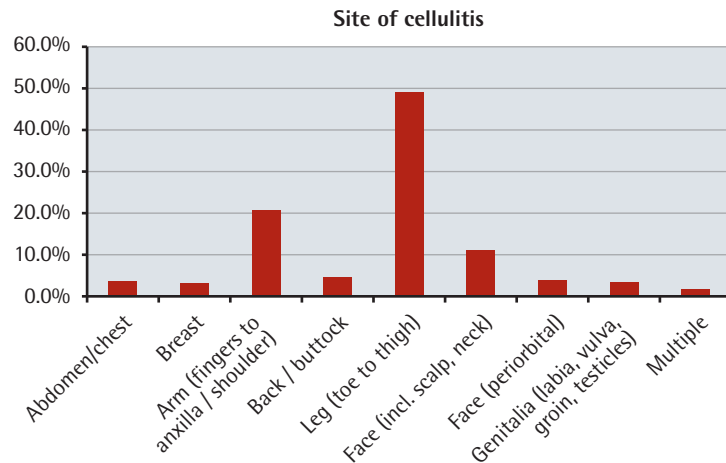
Following guideline implementation data shows that there has been a decrease in the use of flucloxacillin from 59% to 22% and an increase in cephazolin use from 1.9% to 59.6% (Figure 4).

Analysis of the doses of antibiotics given indicated a wide range of dosing particularly for flucloxacillin with the recommended dose of 1gm four times a day not being used, but variation of this presumably for convenience. Following introduction of the guidelines, 52.3% of the cephazolin doses have been given as recommended by the guidelines. A further 24.5% have used the 2gm daily but there is no indication as to whether the probenecid was co-prescribed (Table 1).

As a result of implementing the cellulitis guidelines, the average duration for a patient on IV antibiotics has increased from two to 2.4 days, whereas the number of IV doses given has decreased from 3.9 to 2.8 (Table 2).

Prior to implementing the guidelines, the average admission rate was 13.8%. After implementation the admission rate since April 2003 was 11.3% and has been 10.2% in the 12 months of January 1st 2004 to December 31st 2004. This difference is not statistically significant. While the admission rate has reduced for the group receiving flucloxacillin, the cephazolin group has the lowest hospital admission rate at 3.6%, though

Figure 3. Site of cellulitis



this difference is not statistically significant (Table 3).

Clinical cost

Prior to the guidelines, the average cost of treating a case of cellulitis under the POAC service was \$278.98. Following introduction of the guidelines, the cost was \$246.36, giving a reduction of cost to the service of \$32.61 per case.

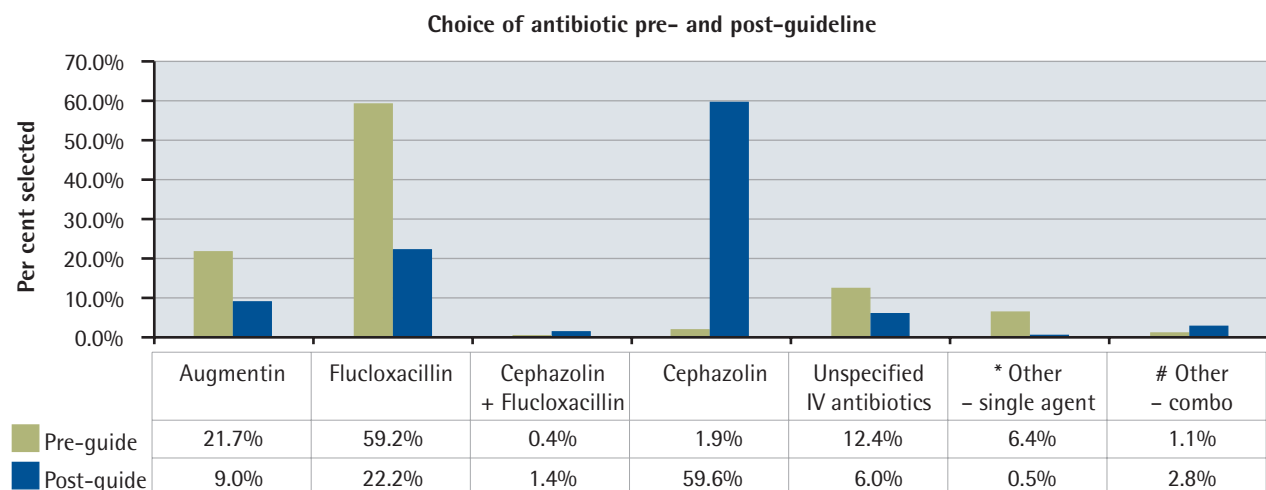
Another cost consideration is the cost saving from preventing a hospital admission. Current figures indicate that the average cost for an

episode of cellulitis admitted to Middlemore Hospital is \$858.86 per day amounting to approximately \$3,000.00 per episode (average length of stay of 4.4 days).¹⁰

Discussion

POAC has evolved into a sustainable service that supports general practice to facilitate an acute episode of care for their patient in the community. In doing so best practice guidelines were established and recommended for general practice use in the management of cellulitis in the community.

Figure 4. Antibiotic use before and after the introduction of the guideline in March 2003



All changes in choice of antibiotic except 'other combinations' have $p < 0.05$

* other single agents used included amoxicillin, cefuroxime, ceftriaxone or penicillin.

Combination therapies included flucloxacillin and Augmentin(r), amoxicillin or cephazolin and cephazolin plus Augmentin(r), amoxicillin or cefuroxime.

Our review of the utilisation of the guidelines indicate that the introduction of a practical but evidence-based guideline for the use of intravenous antibiotics in treating cellulitis in the community is clinically safe and allows people to be treated at home in a primary care driven model, as also demonstrated by Corwin et al.⁹ The financial cost of treatment at home, avoiding admission to hospital, is a substantially less expensive option.

While historically hospitals have driven the process of intravenous antibiotics, we believe our general practice teams have the ability to manage IV therapy for cellulitis in primary care and POAC supports this by promoting clinical guidelines.

Future plans

POAC will continue to encourage primary care physicians to access and utilise the guidelines established for primary care. These guidelines not only include *Cellulitis* but *Investigation for Acute Coronary Syndrome and Deep Vein Thrombosis*.

This year POAC is working more closely with Middlemore Hospital and, through our early discharge service, we are encouraging hospital teams to refer appropriate patients with cellulitis back into the community for treatment under POAC using the guidelines.

Our 2005/2006 plan involves the promotion of the *Oral Rehydration Therapy* guidelines in children, along with the review of respiratory infection referrals which have increased significantly over the past twelve months. This may also lead to the establishment and implementation of guidelines for managing these patients in primary care.

Work is currently underway looking at the treatment of deep vein thrombosis in primary care, including the use of low molecular weight heparin and the initiation of warfarin.

Acknowledgements

Dr Campbell Brebner, Current POAC Clinical Director, Drs Tane Taylor, John Roke and Tony McClelland, cur-

Table 1. Common doses of intravenous antibiotics

| Antibiotic | Dose | Pre-guide | Post-guide |
|----------------|------------------------|-----------|------------|
| | | Per cent | Per cent |
| Augmentin® | Stat | 3.6% | 11.6% |
| | 1.2gm d | 16.1% | 16.3% |
| | 1.2gm bd | 57.1% | 36.0% |
| | 1.2gm tds | 17.9% | 31.4% |
| | Other | 5.4% | 4.7% |
| | | N = 56 | N = 86 |
| Flucloxacillin | 1gm stat | 5.5% | 18.8% |
| | 1gm daily | 7.6% | 15.7% |
| | 1gm bd | 28.3% | 21.5% |
| | 1gm tds | 4.8% | 13.8% |
| | 2gm stat | 9.7% | 6.1% |
| | 2gm daily | 2.1% | 5.7% |
| | 2gm bd | 20.7% | 7.7% |
| | Other | 21.4% | 10.7% |
| | | N = 145 | N = 261 |
| Cephazolin | 1gm stat | | 2.3% |
| | 1gm daily + probenecid | | 3.7% |
| | 1gm daily - probenecid | | 5.1% |
| | 2gm stat + probenecid | | 2.0% |
| | 2gm stat - probenecid | | 7.2% |
| | 2gm daily + probenecid | | 52.3% |
| | 2gm daily - probenecid | 100% | 24.5% |
| | Other | | 2.8% |
| | | N = 5 | N = 641 |

Table 2. Average dose and duration

| | Pre-guide | Post-guide |
|---|-----------|------------|
| Average duration on IV antibiotics (days) | 2.0 days | 2.4 days |
| Average number of doses given | 3.9 doses | 2.8 doses |

Table 3. Percentage of people admitted according to antibiotic used

| | Pre-guidelines | | Post-guidelines | |
|----------------|----------------|---------|-----------------|---------|
| Augmentin | 9 / 56 | (16.1%) | 13 / 86 | (15.1%) |
| Flucloxacillin | 20 / 145 | (13.8%) | 17 / 261 | (6.5%)* |
| Cephazolin | – | | 23 / 641 | (3.6%) |

* p = 0.033 for pre- vs post-guidelines

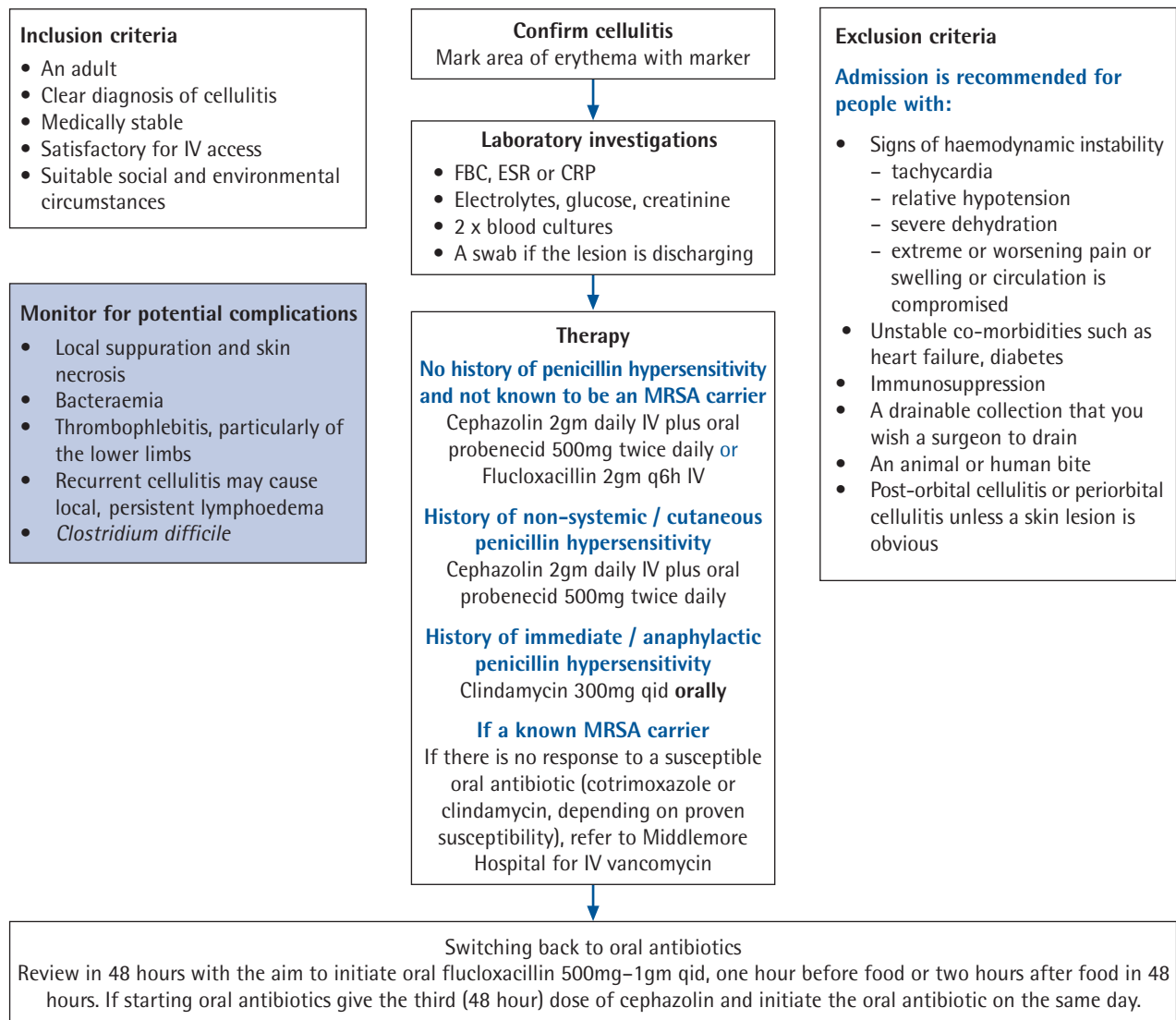
rent POAC Clinical Oversight Board and contribution to the cellulitis guidelines from Dr Selwyn Lang, Clinical Microbiologist Counties Manukau DHB.

Competing interests

Harley Ash is a shareholder in, and director of, Procure Health Ltd. Gina Barker and Linda Bryant declare no competing interests.

Figure 5.

CMDHB POAC Adult Cellulitis Algorithm



BEDREST AND ELEVATION OF THE AREA OF CELLULITIS IS CRUCIAL.

This guideline is intended to assist clinical decision making only and is not entirely inclusive or exclusive of all methods of reasonable care. It should not replace professional clinical judgment in managing each individual patient.

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