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Review of antibiotic use in respiratory disorders at a regional hospital in Queensland

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ABSTRACT

Adherence to antibiotic guidelines has been shown to improve outcomes in several clinical situations. Respiratory conditions are a major cause of mortality and morbidity in Queensland. A recent study showed low levels of compliance with antibiotic guidelines in a Queensland metropolitan hospital. We undertook an audit of antibiotic use in a regional Queensland hospital against Therapeutic Guideline recommendations. Therapeutic Guideline recommendations were followed in 16% of cases with ceftriaxone the most commonly prescribed. Re-admission rate within 28 days was for 53%, 26%, 11% and 5% respectively for ceftriaxone, benzylpenicillin, amoxicillin/clavulanate and ceftriaxone combined doxycycline. Less than half of patients treated for pneumonia had concordant radiographic changes. Admission via the emergency department may be a factor in the preference for intravenous injection of ceftriaxone and presence of non-infective co-morbidities may also contribute to re-admissions. Considerable challenges exist in improving compliance with antibiotic guidelines which can improve patient outcomes and antibiotic stewardship.

1. Introduction

Antimicrobial resistance continues to be on the increase, while the development of new therapies has come to a standstill (Bauer et al., 2010). Reviewing recent rates of the spread of resistance, mankind's ability to fight serious infections, including the use of prophylactic antimicrobial therapies, in regards to control of infection in surgery, will be very soon compromised (Liñares, Ardanuy, Pallares, & Fenoll, 2010). Antimicrobial stewardship programmes have been seen to be implemented worldwide with the aim of these programmes being guidelines assist in the optimisation of antibiotic therapy so that the risk of subsequent development of resistance is minimised (Bauer et al., 2010).

Adherence to antibiotic management guidelines has been shown to save lives and costs in diverse settings (Elemraid et al., 2014; Hecker et al., 2014; Wilke, Grube, & Bodmann, 2011). These allow better use of health resources and reduction of antibiotic drug resistance which are global challenges (Wilke et al., 2011). Selecting an appropriate antibiotic regimen for patients, especially those with bacterial infections, has an important role in overall patient management (Elemraid et al., 2014; Hecker et al., 2014; Wilke et al., 2011). A delay in the appropriateness of antimicrobial therapy has been identified as an important determinant of clinical outcome (Ibrahim, Sherman, Ward, Fraser, & Kollef, 2000).

Suboptimal use of antibiotic best practice guidelines in the management of patients with respiratory diseases continues to be of concern. In particular, the emergence of multi-resistance pseudomonas aeruginosa which can increase mortality, the risk of treatment complications and duration of admission and costs (Desai et al., 2010; Montero, Dominguez, Orozco-Levi, & Salvado, 2009). Aditionally, in Australia there has been a steady increase in the number of reports of Vancomycin Resistant Enterococcus (VRE) (Cosgrove, Carroll, & Perl, 2004; Elemraid et al., 2014). Vancomycin is the standard treatment for methicillin-resistant staphylococcus aureus (MRSA).

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Table 1
Scoring system for the CORB Score.

CORB score which identifies patients with a high mortality risk and when appropriate score 1 point for each of:
Confusional state (acute)
Oxygen saturation ⇐ 90% in room air
Respiratory rate ≥ 30/min
BP: systolic < 90 mmHg or diastolic BP ⇐ 60 mmHg
Score of > 1 has sensitivity 81%, specificity 68%, PPV 18%, NPV 98% and area under ROC 0.74 for requiring intensive respiratory or vasopressor support

Up to 66% (51 out of 77) of Victorian hospitals are reportedly not meeting best practice prescribing guidelines when administering broad-spectrum cephalosporin (Robertson et al., 2002). This inertia surrounding the inappropriate use of antimicrobials contributes to the emergence of antimicrobial resistance.

In Queensland, respiratory conditions were the largest broad cause of mortality contributing to 13,067 hospitalisations in 2011–12 (Elemraid et al., 2014; Queensland Health, 2014). Furthermore, the mortality rate for chronic obstructive pulmonary disease (COPD) is 9% higher than the national rate and third highest of the states and territories (Queensland Health, 2014). Pneumonia and influenza deaths totalled 389 in 2010 with 15,684 hospitalisations in 2011–12b (Elemraid et al., 2014).

According to the Therapeutic Guidelines [TG] (2014b), mild community acquired pneumonia (CAP) is treated with oral amoxicillin or doxycycline, moderate CAP with benzylpenicillan and doxycycline, unless an allergy to penicillin is noted or are identified as being in a tropical region only then does the TG recommend ceftriaxone. Moxifloxacin is also an alternative in this case, especially if there is an immediate hypersensitivity to penicillin. Antibiotics are not recommended for influenza although antivirals can be prescribed such as oseltamivir and zanamivir. Reduced mortality has been demonstrated by McGeer et al. (2007) when antivirals are commenced in the hospitalised cohort providing they are commenced early.

Within the context of COPD adherence to best practice, prescribing guidelines were inadequate (Fanning, McKean, Seymour, Pillans, & Scott, 2014). The Australian Lung Foundation COPD-X Plan (2016), which endorses the TG (2014a), recommends the use of doxycycline or amoxicillin oral as first-line antibiotic therapy for exacerbation of COPD; however, some studies demonstrate differing regimes across Australian hospitals (Robertson et al., 2002).

The National Asthma Council Australia, does not recommend an antibiotic regimen for acute episodes of asthma, unless there are clinical symptoms and objective tests to confirm a bacterial infection. This is endorsed in the publication the Australian Asthma Handbook (2014), which underpins evidence in relation to the national guidelines for the management of asthma.

The TG (2014a, [Therapeutic Guidelines, 2014b]2014b), recommends using severity scoring systems such as: CORB Score (Table 1); CURB 65, (Table 2) and the SMART-COP (Table 3).

These scoring systems have been developed to predict mortality risk in community acquired pneumonia (CAP), and these have been applied to guide physicians in regards to patients' admittance to the hospital or to the intensive care unit (ICU). These tools, however, were initially developed to predict mortality risk, and studies have demonstrated that the mortality risk does not always equate with the need for hospitalisation or ICU care (Niederman, 2009). When administering antibiotics to people with respiratory conditions, it is evident that adherence to best practice guidelines is variable. The aim of this study was to quantify the use of antibiotics in respiratory disease in a Regional Hospital and to access the adherence or non-adherence to TG best practice guidelines for antibiotics in this cohort of patients.

Table 2
Scoring system for CURB 65.

CURB 65 which estimates mortality of community acquired pneumonia and the need for admission:
Confusion of new onset (defined as an abbreviated mental test score (AMTS) of 8 or less)
Blood **U**rea nitrogen greater than 7 mmol/L (19 mg/dL)
Respiratory rate of 30 breaths per minute or greater
Blood pressure less than 90 mmHg systolic or diastolic blood pressure 60 mmHg or less
Age **65** or older
0–1: Low risk
2–5: Higher risk
If the cumulative score is 0 or 1, then most likely this patient could be safely treated as an outpatient.
A score of 2 might suggest closely supervised outpatient treatment, or inpatient observation admission. A score of 3, 4, or 5 would usually indicate inpatient treatment.
It is important to emphasize that clinical judgment should be the primary factor in the decision for hospital admission, with the CURB-65 score providing assistance with this decision.

Table 3
Scoring system for SMART-COP.

SMART-COP which is similar to the CORB and predicts the need for intensive support to accurately assess patient severity and appropriately prescribe antibiotic therapies or admissions:
• all items get 1 point EXCEPT BP, Oxygen and pH parameters which get 2 points, giving a maximum score of 11
• different calculators depending on age
Risk of needing intensive respiratory or vasopressor support
• scores 0–2 = low risk
• scores 3–4 = moderate risk (1 in 8 chance)
• scores 5–6 = high risk (1 in 3 chance)
• scores 7 or more = very high risk (2 in 3 chance)
• a score of 3 or more gives sensitivity 92%, specificity 62%, PPV (positive pressure ventilation) 22%, NPV (negative pressure ventilation) 99%, area under ROC 0.84
Age ≤ 50 years
• **S**ystolic BP < 90 mmHg
• **M**ultilobar CXR involvement
• **A**lbumin < 35 g/L
• **R**espiratory rate ≥ 25/min
• **T**achycardia ≥ 125/min
• **C**onfusion (acute)
• **O**xygen low (PaO_2 < 70 mmHg, or SaO_2 ⇐ 93%, or PaO_2/FiO_2 < 333)
• **p**H < 7.35
Age > 50 years
• **S**ystolic BP <90 mmHg
• **M**ultilobar CXR involvement
• **A**lbumin < 35 g/L
• **R**espiratory rate ≥ 30/min
• **T**achycardia ≥ 125/min
• **C**onfusion (acute)
• **O**xygen low (PaO_2 < 60 mmHg, or SaO_2 ⇐ 90%, or PaO_2/FiO_2 < 250)
• **p**H < 7.35

2. Methods

This study used retrospective chart review (RCA) patient data at one regional acute care facility. The RCA research methods are commonly used in health research and use patient information to answer the specific research question (Vasser & Holtzmann, 2013). Ethical approval to conduct the retrospective chart audit (RCA) was approved and received from the participating site Human Research Ethics Committee (ECOO172).