# Prevailing Practice Versus Clinical Guideline: The In-Patient Assessment And Management Of Childhood Bronchopneumonia In A Malaysian District Hospital

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**Introduction:** Pneumonia is the most common diagnosis made in hospitalised children. The Malaysian Clinical Practice Guidelines on pneumonia and respiratory tract infections provides a comprehensive guidance in the local context. We evaluated the documented assessment and management of children diagnosed with pneumonia admitted to the children's ward, Hospital Batu Pahat against this guideline.

**Methods:** We performed a retrospective analysis of hospital case notes for children admitted from January to May 2004.

**Results:** Ninety six case notes were analysed. Most patients (84%) had at least four positive clinical features leading to the diagnosis of pneumonia. 92% met the guideline criteria for admission. Sp02 was performed for 58% on admission, and 58% with reading below 95% received supplemental oxygen. Throughout hospital stay, each patient had an average of four investigations (range: 1 – 12). Among 23 patients who had further investigations, justifications were only recorded in seven patients (30.4%), and changes in management resulted in 23%. The most common antibiotic prescribed was intravenous Penicillin (97 %). In 17 patients who met the guideline classification for severe pneumonia, none received the recommended antibiotic combination. The median time to fever resolution was 22 hours (range 2 – 268), and median hospital stay was 3 days (range 1 – 12).

**Conclusions:** Although the quality of clinical assessment and antibiotic choices were acceptable, there was a failure to critically evaluate patients according to disease severity and initiate corresponding investigations and managements. Future efforts need to be directed at promoting further guideline adherence and the exercise of critical judgment in patient evaluation.

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Pneumonia is the leading cause of childhood morbidity throughout the world, and remains the leading cause of mortality in the developing countries[1]. Clinical presentation of pneumonia in children overlaps widely with other acute respiratory conditions, like acute viral bronchiolitis, viral upper respiratory tract infections and other febrile illnesses. Differentiating bacterial from viral pneumonia presents another challenge, even for experienced clinicians. As a result, uncertainties often exist in the diagnosis, investigations and management of this condition1, leading to variations in care and patient outcomes.[2] The introduction of clinical practice guidelines aims to standardise management and impart quality to the care process. The Malaysian Clinical Practice Guidelines on pneumonia and respiratory tract infections in children was developed in 2002 to provide national guidelines on common childhood respiratory infections, covering the criteria for admission, diagnosis, investigation and treatment.[3]

Children diagnosed with pneumonia account for over a quarter of nearly 250 acute admissions to the children's ward at Hospital Batu Pahat, Malaysia. As a district hospital with limitations in its investigative capacity and efficiency, clinical judgment is often relied on as the primary means in making diagnoses and guiding acute management. The Malaysian Clinical Practice Guidelines on pneumonia and respiratory tract infections in children has been taken as the unit protocol since its publication. However there has been no formal evaluation to date in our unit on the quality of our clinical services, in particular the justifiability of diagnosis, investigations and treatment with reference to the guidelines. We decided to undertake this clinical audit to evaluate how well the guidelines have been followed in the acute medical management of children with pneumonia in this hospital.

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**Objectives**

To evaluate the following using the Malaysian Clinical Practice Guidelines on pneumonia and respiratory tract infections in children (2002) as the reference standard where applicable:

i. Admission criteria: whether children were admitted according to the indications specified in the guideline.

ii. Diagnosis: whether the diagnosis of pneumonia is made with an appropriate combination of clinical features.

iii. Oxygen monitoring and administration: whether all cases of suspected pneumonia had pulse oximetry ($SpO_2$) monitoring on admission, and whether supplemental oxygen was administered when needed (when $SpO_2 < 95\%$).

iv. Investigations: Whether all cases clinically diagnosed with pneumonia had Chest X Ray performed. For cases of severe pneumonia, whether blood culture was taken. Whether appropriate clinical indications were documented if other relevant investigations were performed, and how many of these investigations resulted in a change in management.

v. Pattern of antibiotic use and its justifications: whether the use of antibiotics are in line with the recommendations.

**Methods**

This is a retrospective case note study conducted in January 2005, involving patients diagnosed with pneumonia who were admitted to the children's ward, Hospital Batu Pahat in year 2004. We aimed to evaluate the first 100 case notes retrievable from the Medical Records Department within this period, starting from the patients admitted in January 2004. Patients diagnosed with "bronchopneumonia", "pneumonia", "bacterial pneumonia" or "partially treated bronchopneumonia" were first identified from the ward census document. Patients who were diagnosed with "atypical pneumonia" or "viral pneumonia" were excluded. After a name list was generated from the ward census, corresponding case notes were retrieved from the medical records. Relevant information was transcribed from the case notes onto a dedicated data collection form.

To estimate the time taken from admission to the measurement of $SpO_2$, the case notes were inspected to look for the first $SpO_2$ reading. If a $SpO_2$ reading was found in the admission document (nursing or medical), the time would be recorded as 0 (zero). If the first $SpO_2$ reading was found in the subsequent entries in the case notes or the observation charts, time difference to the closest minute between the admission time and the time of first $SpO_2$ recording would be reported. Time of admission was taken as the earliest time recorded in the admission documents, either from the medical or nursing entries.

Fever resolution is defined in this study as temperature lower than 37.5 °C without re-spiking. Time to fever resolution was estimated to the closest minute.

All information from the data collection forms were subsequently collated and analysed using Microsoft Excel version XP. Standard descriptive statistics were presented.

This study was approved by the Hospital Advisory Committee, Hospital Batu Pahat and Quality Improvement Unit, International Medical University, Malaysia.

**Results**

The sample comprises the first 100 consecutive patients whose case notes were available from the medical record department. These patients were admitted within the period from 1 January to 31 May 2004. In four patients, the diagnosis appeared to be recorded in error in the ward census, as there was no mention of pneumonia in the case notes at any stage of their stay. This leaves 96 case notes for analysis. The baseline characteristics of patients are listed in Table I.

Most patients (70.8%) presented at or after day three of illness (median: 3, range: 1 to 30). Thirty three

patients (34%) had been given antibiotics prior to admission. Eight patients had previous history of admission for pneumonia, while five had significant underlying chronic diseases (congenital heart disease: 4, cerebral palsy: 1).

Figure 1 : shows the symptoms reported by patients. Fever and cough, present in around 94% of patients, were most commonly reported. The number of symptoms reported per patient ranged from one to seven (median and mode: three).

Figure 2 : illustrates the clinical signs on admission. The number of positive clinical signs on admission ranged from none (n = 9) to six, with both the median and mode being two. Crepitations on auscultation, tachypnoea, wheeze and recessions were most commonly detected. Sixty-four patients (65%) were febrile on admission, among whom 20 had a temperature of more than 38.5 °C. Combining symptoms and signs, all except one patients in the sample had two or more positive documented clinical features, and 84% (n = 81) had four or more positive clinical features leading to a clinical diagnosis of bronchopneumonia.

Seventeen patients were clinically classified as having severe pneumonia with chest in-drawing, accessory muscle use and/or altered consciousness. On the other hand, ten patients had milder features, which are more suggestive of non-bacterial illnesses like viral bronchiolitis. These patients included those who were less than two years-old, who presented without fever on admission, and had relatively mild respiratory symptoms or signs with no history of antibiotic use prior to admission.

In the Malaysian Clinical Practice Guidelines, the following indicators are suggested as the criteria for admission: age of three months and below, high fever (> 38.5 °C), poor feeding and/or vomiting, rapid breathing with or without cyanosis, systemic manifestations, failure of previous antibiotic therapy, recurrent pneumonia and severe underlying disorders (3). Ninety two percent of patient in this sample met the criteria for admission. Among the nine patients who did not meet the criteria, one patient was found to have wheeze, whereas no justification for admission was recorded for the remaining cases.

Fifty six out of 96 patients (65.1%) had their oxygen saturation measured using pulse oximeter ($SpO_2$) on admission. Seventy-four percent of patients had their $SpO_2$ measured less than 20 minutes from the time of admission. However, seven patients had their first monitoring later than one hour after admission (total range 0 – 1380 min), and ten never had any documented oxygen saturation. Twenty six patients (27%) had an $SpO_2$ reading of lower than 95%. However, only 15 (57.7%) of them received supplemental oxygen.

Chest radiographs were taken in 91 patients (94.8%), out of whom 83 (86.5%) were considered by the attending doctor as having findings suggestive of pneumonia. There was no mention of chest radiograph in five patients. Full blood count was performed on 94.8% of patients on admission., among whom 40.2% showed leucocytosis and 17.4 % with neutrophilia (neutrophils exceeding 65% of total white cells). Blood cultures were performed in ten patients in total (10.4%). However, among those clinically classified as severe pneumonia (n=17), only two had blood culture taken. On average, each patient has four investigations during hospital stay (range: 1 – 12). Notably, among the 23 patients who had further investigations post-admission, justifications were only recorded in seven patients (30.4%).

The overall microbiological yields in this sample were small. Among all the microbiological investigations taken throughout the in-patient course of this sample (total no: 26), only two cases were positive for bacteria. Klebsiella pneumoniae was identified in both of these cases, one via nasopharyngeal aspirate and the other via throat swab. There was no positive blood culture from all ten samples taken.

On admission, all patients received antibiotics, with the types of antibiotics given as shown in Table III. Eighty nine patients (92.7%) received intravenous antibiotics, six (6.3%) had oral antibiotics and two (2.1%) were given combined intravenous and oral antibiotics. Five patients (5.2%) were given two intravenous antibiotics on admission. All patients who received intravenous antibiotics on admission were kept on this route until discharge.

One patient had a change in antibiotics (from Penicillin to Cefuroxime) and ten received additional antibiotics. The reasons for these changes in management were not documented in any of the case notes, and could only be deduced in some patients from their clinical courses. Possible reasons included persistently high temperature after 24 hours of admission (n = 6), young age of below one year (n = 3), and in the remaining two patients, no possible justification could be found. It was remarkable that despite the number of additional investigations undertaken post admission, as illustrated in table 2, changes in management (i.e. addition or change in antibiotics) only occurred in three out of 23 patients (13%). Among the 17 patients with severe pneumonia, only four received combined antibiotic therapy, and in none the combination consisted of a second or third generation cephalosporin with a macrolide, as recommended in the Malaysian Clinical Practice Guidelines. In 87 out of 96 patients, the total planned durations of antibiotics were identified, with a median duration of seven days (range: 2 – 13. Mode: 7). Seventy-six patients within this group had documented findings of pneumonia on chest radiograph, among whom only 62 (82%) were given five or more days of antibiotics.

There was neither death nor intensive care unit admission within this sample of patients. The median time to resolution of fever was 22 hours from admission (range: 2 to 268 hours, mode: 8 hours), and 69 patients (72%) became afebrile within 48 hours of admission. Antipyretics were given to all but one patients. An extreme case of prolonged fever (268 hours from admission) was identified to be a one-month-old previously healthy male infant with four-day history of fever, cough and poor feeding, who had tachypnoea and moderate fever on admission, with chest radiograph findings suggestive of bronchopneumonia. He received three consecutive courses of intravenous antibiotics (penicillin, cefuroxime and co-amoxyclav). Full blood count for this infant on admission was normal, and further investigations including C-Reactive Protein, nasopharyngeal aspirates and urine microscopy were unremarkable. Blood culture was never performed for this infant.

The median length of hospital stay was three days (range: 1 – 12 days, mode: 3 days). Seventy patients (72.9%) were given antibiotics to take home, with oral Penicillin (n = 60) and Erythromycin Ethylsuccinate (n = 5) being the most commonly prescribed antibiotics. There were two readmissions within two weeks of discharge with pneumonia.

**Discussion**

This report serves to explore the pattern and highlight some strengths and deficiencies in the medical and nursing care of children admitted with pneumonia in our hospital.

It was encouraging that 92% of our patients met the criteria for admission in the Malaysian Clinical Practice Guideline. However, for the remaining patients who did not meet the criteria, no individual justifications for admission were recorded. It appears that all patients referred from Accident and Emergency Department were routinely admitted, despite the fact that not all such referrals were truly in need of in-patient stay. The option of short observation of four to six hours in the children's ward should be considered before making a decision to admit or to discharge. Patients who remain relatively well at the end of the observation period, for instance those with mild or no fever, with good oral intake and no respiratory distress can be discharged with oral antibiotics and parental education. By avoiding unnecessary admissions and facilitating early discharge, a reduction could be achieved in the cost of care.[4]

In this report, relevant clinical features were sufficiently documented in general. A combination of symptoms and signs were obtained leading to a clinical diagnosis of pneumonia, with nearly 85% had at least four relevant clinical features recorded. The commonest reported symptoms and signs in this study are generally in agreement with other studies.[5-8] Tachypnoea, which has been reported as the most sensitive sign of pneumonia[8-11], was only present in less than 50% of patients in this study. This discrepancy could be due to the way respiratory rates were assessed. In actual clinical practice as reported in this paper, it is likely that tachypnoea is diagnosed through a quick inspection of the patients without quantifying the respiratory rate as in a study setting. Consequently, there is a significant chance of missing patients with mild tachypnoea. In addition, this study examines the symptoms and signs in relation to clinical diagnosis of pneumonia, as opposed to diagnosis using a gold standard test like radiologist-reported chest X ray findings.

Delayed pulse oximetry measurement, as defined in this study as measurement later than 20 minutes after admission, was found in one quarter of the cases. Furthermore, oxygen supplementation was not given to nearly half of those who had $SpO_2$ reading of lower than 95%. This finding points to a need for greater efforts from the nursing staff in identifying and managing patients in respiratory distress before doctor's assessment. Pulse oximetry is an integral part of bedside monitoring, and all patients with respiratory symptoms or signs should have immediate oxygen saturation monitoring and supplementation where required. Enforcing the message by nursing education, accompanied by a written policy is imperative to improve the quality of our clinical services.

The prime issue of concern arising from in this audit is the apparent failure to critically evaluate patients based on the clinical information collected during acute assessment, and to tailor management plan accordingly. It appears that a common set of management plan was made for all patients, including children with severe pneumonia and those without typical features of pneumonia. Specifically, ten patients with clinical features strongly suggestive of acute viral bronchiolitis (young patients with mild fever, coryza and mild respiratory distress with or without wheeze) were diagnosed and managed as pneumonia; and most of the 17 patients with severe pneumonia were investigated the same way as for other cases, with blood culture taken in only two patients. An array of investigations were ordered, many without recorded indications, and few actually led to new clinical decisions or a change in management. The failure to critically evaluate patients and tailor management plan to disease severity echo the findings of other studies in children and adults.[2,12]

It was reassuring to see the recommended first line antibiotics of Penicillin being used in the vast majority of patients, with low rate (2%) of antibiotic change during their in-patient course. However, we were concerned that all children in this sample received antibiotics on admission. Although children diagnosed with viral pneumonia were excluded from the analysis, there was a possibility that some children in this sample had features of viral pneumonia, for whom a decision by the attending doctor to refrain from prescribing antibiotics on admission would be appropriate. We acknowledge however the difficulty in differentiating between bacterial and viral pneumonia in actual clinical practice, and the retrospective nature of this study does not allow us to undertake a more detailed assessment in this regards. On the other hand, nearly 20% of patients with X ray-supported diagnosis of pneumonia were not given what is generally considered a full course of antibiotics, i.e. five days or longer. Besides, the choice of intravenous route throughout the hospital stay regardless of the patients' clinical status was questionable, and again reflects a possible failure to critically evaluate and manage patients. While the Malaysian Clinical Practice Guideline does not clearly specify indications for different routes of antibiotics[3], evidence exists that oral antibiotics appear to have similar effectiveness as compared to parenteral antibiotics for uncomplicated childhood pneumonia[13], and early switch from intravenous to oral antibiotics at

48 hours or at the point of fever resolution has been shown to decrease length of stay, improve cost-effectiveness and patient satisfaction without compromising the overall quality of care.[4,14]

Within the limitations of a retrospective case note study, with reliance only on documentation, relatively small sample and the lack of gold standard for comparison in the diagnosis of bronchopneumonia, we obtained a real-life snapshot of the assessment and management of this condition in a Malaysian district hospital with reference to the national Clinical Practice Guideline. In summary, the main principles of the guideline appeared to be well-followed in clinical assessment and antibiotic choices, although we were concerned that all children were given antibiotics on admission, which reflected possibly an unwillingness on the part of the attending doctor to consider viral pneumonia and refrain from giving antibiotics. Other deficiencies noted included delay in pulse oximetry measurement and suboptimal documentations of justifications for clinical decisions, with corresponding recommendations put forward for medical and nursing staff. However, the most important finding in the survey was the apparent failure to exercise critical judgment in evaluating disease severity, selecting investigations and planning management. While constant reminder and regular monitoring to facilitate practice guideline adherence might be useful to improve care[15-17], guidelines serve to inform sound clinical judgment, the proper exercise of which on top of the standards required for the guidelines could lead to further improvements in the quality and cost-effectiveness of care.[18-20] This, as our study testifies, presents a bigger challenge to address in our clinical service.

Conflict of Interest: None declared

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## TABLES AND FIGURES

TABLES

Table I: Baseline Characteristics of Patients

| CHARACTERISTICS (N = 96) | NO OF PATIENTS (PERCENTAGE) |
|---|---|
| ***AGE (MONTHS)*** | |
| < 1 year | 36 (38) |
| 1 to 7 years | 55 (57) |
| > 7 years | 5 (52) |
| ***MALE / FEMALE*** | 57/39 (59.3/40.7) |
| ***RACE*** | |
| Malay | 85 (88.5) |
| Chinese | 11 (11.5) |
| ***AREA OF RESIDENCE*** | |
| Batu Pahat district | 93 (96.9) |
| Other area | 3 (3.1) |
| ***SOURCE OF ADMISSION*** | |
| General Practitioner | 30 (31.3) |
| Accident and Emergency Department | 51 (53.1) |
| Private Paediatrician | 7 (7.3) |
| Others | 8 (8.3) |

Table II: Antibiotics given on Admission

| ANTIBIOTICS (INTRAVENOUS UNLESS SPECIFIED) | NO (%) |
|---|---|
| Crystalline Penicillin | 81 (84.3%) |
| Cloxacillin | 6 (6.3%) |
| Co-amoxiclav | 2 (2.1%) |
| Gentamicin | 4 (4%) |
| Cefuroxime | 2 (2.1%) |
| Penicillin V (oral) | 2 (2.1%) |
| Erythromycin (oral) | 6 (6.3%) |

**seven patients were given two antibiotics on admission*

FIGURES

Figure 1 : Symptoms documented

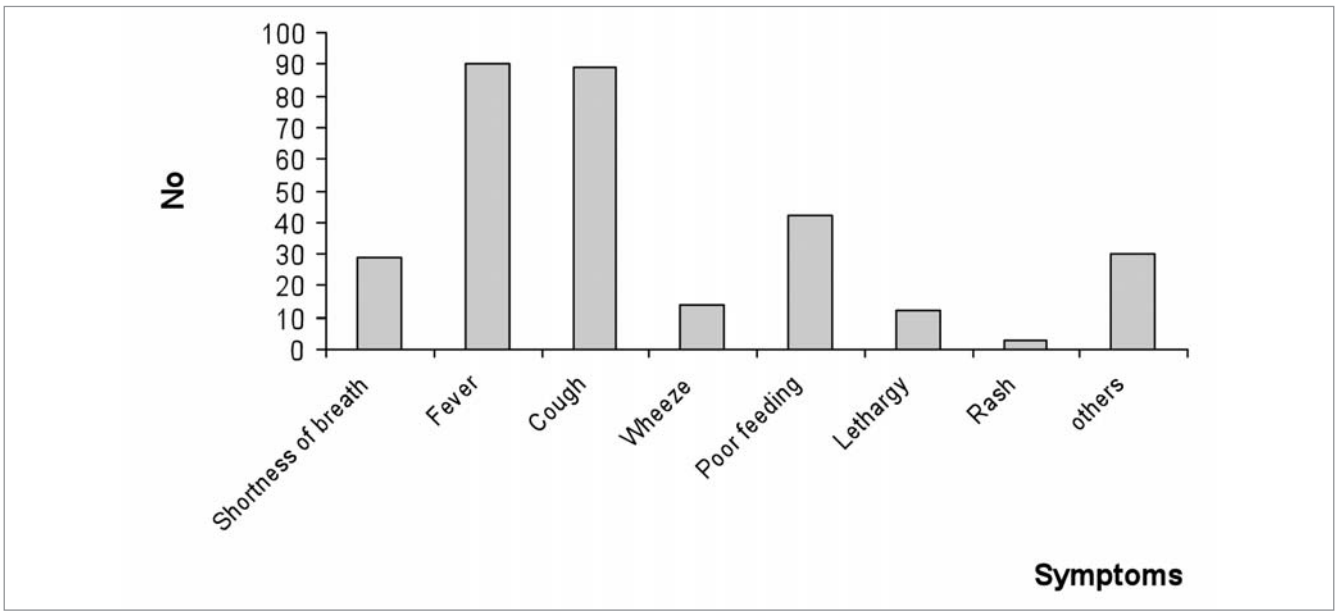


Figure 2: Signs documented