CHAPTER V

DISCUSSION

There were no significant differences between the 2 groups in terms of temperature and leucocyte counts.
Blood culture in the pneumonia group revealed H.influenzae in 2 out of 11 cases (18%), while none revealed S.pneumoniae. Since there were only a few blood cultures taken, the results could not reflect the etiology of pneumonia.

Rales were heard in 33% non-pneumonia cases. Since all diagnoses were made radiologically,it could be due to other lower respiratory infections caused by virus which were common in infants such as bronchiolitis. Rales were commonly heard in bronchiolitis , but radiologically only showed interstitial infiltrations (Caffey, 1961).

The objective of diagnostic test for screening is to detect disease in its earliest, presymptomatic state when, presumably, it is less less widespread and more easily treated. An ideal screening test would share many characteristics of ideal diagnostic test in general. Sensitivity, specificity, and predictive values should all be close to 100 percent. But such test do not exist.

The initial tendency would be to use a sensitive test. Such a test, because it has few false negatives, has a high negative predictive value, meaning that very few individuals with disease will be missed. The trade-off, unfortunately,is that this

type of test has poor positive predictive value,meaning that most positive individuals would be falsely positive. When such a test is used for screening for large populations, a significant number of individuals have positive test but only a small number of them are truly diseased. In the absence of a relatively inexpensive test that is both highly sensitive and highly specific, the choice is between a sensitive test that result in a high proportion of unnecessary diagnostic evaluations, or a specific test that result in sizeable proportion of diseased individuals going undetected. Unfortunately, there is no general rule to depend on here. The choice will depend on whether or not patients will benefit from early disease detection, as well as the relative cost and risk of subsequent diagnostic evaluation (Kaplan,1990).

For this study, the diagnostic test should be able to detect disease whenever it is present, so a test with a high sensitivity and a moderately high specificity is desirable. Because a consequence of missing a case will result in withholding antibiotic treatment and close monitoring in the hospital, it may lead to complication or even death, we have to choose a value for the positivity criterion that minimizes the false negative rate.

In agreement with a community - based study in Basse (Campbell et al.,1988), the results of this study demonstrate that considered alone, a RR over 40/m is a useful indicator of

pneumonia. However, our data reveal that, in contrast to Cherian et al. (1988) that suggested a different cut-off values for different age groups, a RR over 40/m continues to be a useful predictor of pneumonia in all age groups, having a sensitivity between 73-89%, and specificity 44-60%. This findings is also supported by a previous study by Shann et al. (1984) that stated that the child's age had little effect on the RR that best predicted pneumonia. A closer look at Shann's data by Cherian et al. (1988) who made a ROC curve out of the data revealed that RR over 40/m was a better indicator of pneumonia than over 50/m.

The sensitivities of RR over 40/m were between 73-89%, so the false negative rate were low (11-27%). A sufficiently high sensitivity means that a negative result rules out pneumonia.

Due to the small positive cases for radiologically confirmed pneumonia and the small number in a certain age group,this study could not make a ROC curve separately for infants 0-2 months and children 13-60 months for there were several zero values in the 2 by 2 table cells, therefore further analysis is not possible.

For the purpose of screening or to exclude disease, the use of a high sensitivity (73-89%) should be appropriate , since almost all patients with the disease are identified . But since the specificity in this study is low (44-60%) that means a large number of patients (40-56 %) will be falsely identified as having pneumonia with the consequence of giving antibiotics to those who actually do not need it.

Follow-up of these patients for at least 1 week in this study permits evaluation of adverse- effects and other ailments, but we should take into account the long-term economic burden or the emergence of resistant strains of bacteria to a certain drug (antibiotic) as the major concern for the false + patients.

However, since the purpose of the test is to screen for the presence of disease, the low specificity might be acceptable particularly if no alternative test with superior operating characteristics is available (Griver et al.,1981).

A more powerful method of establishing a test's usefullness is to examine the associated likelihood ratio which allows estimates of the probability that disease is present at any level of diagnostic test result (Simel et al.,1991).
The likelihood ratios in this study showed good results except for RR over 30/m and cyanosis, but the width of 95% confidence interval did not substantiate it.

Several explanations may be offered for the poor sensitivity of RR over 50/m and over 60/m in this study.
First, what is considered as a normal respiratory rate in different age groups. Several workers reported the normal respiratory rate, mostly in infants.
In reviewing these studies, a major methodological difference becomes apparent. Either the period of time, time interval and devices used (continuous electronic monitoring, stethoscope, or observation).

Morley et al. (1990) determined the respiratory rate in babies under 6 months by auscultating the breath sounds or putting a warm hand gently on the baby's naked chest and simultaneously counting the respiratory rate 3 times for 15 seconds and getting the average.

He found that the mean and standard deviation of respiratory rate for awake infants is 61 (14), and 42 (12) for sleeping infants. He revealed that the respiratory rate when awake did not correlate with the presence of serious lower respiratory tract infection.

Berman et al.(1991) reviewed 2 studies which have lower respiratory rate. The first by Richards using continuous electronic monitoring in 91 babies that showed the mean respiratory rate and the standard deviation for awake infants of 6 months old was 27.

Secondly, Lanata observing for 60 seconds in infants with a history of cough in Lima, Peru. The results obtained for awake and calm infants of 6 - 11 months showed that the mean rate and standard deviation was 40.89 (5.34).

Simoes in his own study found that the counts obtained by auscultation were an average of 14 breaths per minute higher than those obtained by observing abdominal or chest wall movement.

The stethoscope appears to pick up small breaths that are not appreciated when observing for chest/ abdominal movement.

The method of counting may account for the high mean rates and variability reported by Morley. If healthy infants of 6 months have the mean rate around 30/m according to Richards. Older children might have a mean respiratory rate of less than 30 /m. And children with lower respiratory tract infections tend to have higher RR. So a threshold of 40/m for indicator of pneumonia in all age group might be reasonable in this study that use observation of either abdominal or chest wall movemebt for a full 60 seconds while the child is calm.

What is unexpected, however, is that cyanosis was not more helpful as a sensitive indicator of pneumonia, with 9% sensitivity. But since the specificity was 82%, a positive result rules in pneumonia. A second unexpected finding was that fever was not useful in predicting pneumonia, as there was no significant difference in both groups. This finding accord with those of Leventhal (1982) and also in contrast to the classic signs of pneumonia which consist of cough, fever and rales.

Since the classic signs of a disease often are derived from examining hospitalized or very ill patients , such physical findings may not be as useful in ambulatory patients who are less likely to have present all of the classic signs.

All children in our study had chest radiographs, whether or not they had clinical signs of pneumonia. In developing countries, pneumonia is usually caused by bacterial infection. which results in diffuse alveolar infiltrates or consolidation. Although chest radiographs may be normal in early pneumonia, this is an uncommon findings (Griska,1984).

Judging the reliability of the test, table 3 shows that R is 0.97. There are several opinion for acceptable reliability for a test. Kelly recommended a minimum of 0.94 while Wiener and Stewart suggested 0.85. Thorndike and Hagen suggested 0.75 as a fairly minimal requirement for a useful instrument (Streiner and Norman,1989).In this study the reliability was almost perfect.

The agreement between 2 independent review of the radiographs has a Kappa of 0.65, which is substantial according to Sackett et al. (1991).

In my opinion, the low sensitivity and specificity of several cut - off points of RR as indicator of radiological evidence of pneumonia in children < 5 years old may be due to :

1. The total number of patients in each of the 'positive' group was relatively small, which contributed to sampling error.
2. Although observer reliability had been minimized by properly performed definitive procedure and the results were interpreted with a standard criteria giving a reliability of 0.97 for the test and Kappa 0.65 for the gold standard based on a review of the chest radiographs that performed blindly by an senior radiologist.

   Since this is a clinical judgment and also somewhat subjective interpretation that may result in disagreement among radiologist,perhaps a more rigid definition of pneumonia would be a consensus interpretation of the radiographs by at least 2 experienced paediatric radiologist.
3. Different spectrum of patients to which the test is applied, whether in duration, stage and severity.

   If values for the diagnostic test variable are correlated with the severity of the disease, the test may be readily detect patients with advanced illness, but be less useful for identifying patients in early stages of the disease.
4. Co-morbidity spectrum.

   If there are coexisting ailments which may or may not be related to pneumonia, that can alter the test results in several different ways, such as malnutrition, coexisting pulmonary disease, or the impact of concomittant treatment.

5. Pathologic spectrum . This included consideration of the etiologic agents as well as the morphology of the disease itself (Simel et al.,1991)

In conclusion, taking the whole age group and in infants, fast breathing defines as RR over 40/m is a reliable indicator of radiological evidence of pneumonia . Our data suggest that different cut-off values of RR are not required for infants and older children.

The primary purpose of a screening test is to detect disease whose morbidity and mortality can be reduced by early detection and treatment, such as pneumonia in this study.
However, in clinical setting, the application of a high sensitivity of a test (73 - 89%) permits the physicians to shorten hypothesis - list , avoid expensive and invasive investigations, and speed the patients on to diagnosis, therapy and home (Sackett et al.,1991).
The low specificity might still be acceptable for this study, if no alternative test which has superior operating characteristics is available.

For the whole age group, the presence of a RR over 40/m and chest indrawing was a good indicator of pneumonia with 73% and 82% sensitivity and 59% and 65% specificity, and LR for a positive test of 3.63 and 7.6.

Although rales have 82% sensitivity and 67% specificity and LR for a positive test 8.55 but since there is usually a disagreement amongst clinician over the interpretation of chest physical signs, in many circumstances it would be difficult to implement this to a screening programme in the community.

Use of validated clinical signs for the diagnosis of pneumonia can substantially reduce the overall use of antibiotics in the community, whilst the children who require antibiotic treatment can still be reliably identified.

There was a very good relationship between heart rate and RR and a moderate degree of relationship between temperature and RR.

The diagnostic value of fast breathing and the respiratory rate threshold as indicator of radiological evidence of pneumonia in infants 0-2 months and children 13-60 months in a hospital setting remains to be established.
This deserves further study with a larger sample size in each age group.