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MINI-SYMPOSIUM: BURDEN OF PNEUMONIA

The burden of pneumonia in children: an Asian perspective

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KEYWORDS

acute respiratory infections;
pneumonia;
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Summary Pneumonia results in two million deaths each year among children worldwide (20% of all child deaths), 70% of them in Africa and South-east Asia. Most countries in Africa and Asia record 2–10 times more children with pneumonia (7–40/100 annually) than in the USA. Apart from resource constraints and an overburdened health system, there is lack of uniformity in defining pneumonia. Most nations employ a WHO standard case management protocol using age-specific cut-offs for increased respiratory rates and chest in-drawing for a clinical definition of pneumonia. The limited data available on the causative organisms have identified *Streptococcus pneumoniae*, *Haemophilus influenzae* and viruses such as respiratory syncytial virus (RSV), influenza, para influenza and adenoviruses as the major pathogens. Measles infection increases pneumonia morbidity and mortality. Low birth weight, under-nutrition, hypovitaminosis A, zinc deficiency, lack of breastfeeding, air pollution (including environmental tobacco smoke) and overcrowding increase the risk for pneumonias in children. Standard case management protocols used for acute respiratory infections (ARIs) in these countries have brought down the disease burden but an improvement in the diagnostic algorithm is needed to appropriately recognise those with associated wheeze. Research is needed to find effective and affordable preventive strategies.

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INTRODUCTION

In developing countries, particularly in Asia and Africa, diarrhoea and malnutrition were generally thought to be the major killers of children <5 years old. It was not until a group of workers presented data from Papua New Guinea in the 1980s that the role of acute respiratory infections (ARIs) in under-five mortality, and a simple strategy to help, was brought to the fore.¹ It was estimated that until then, out of the 10 million children who died each year, over 3 million died from pneumonia, 2 million from measles, 1.5 million from pertussis, 1 million from tetanus and the other

2.5 million from other causes. Since pertussis is an ARI and measles deaths are often due to infections of the respiratory tract, ARIs were probably associated with more deaths than any other single cause. This resulted in a new focus on these areas and public health measures were devised to decrease this burden in subsequent years. A more recent estimate suggests that pneumonia still causes around 2 million (95% confidence interval (CI) = 1.6–2.2 million) children's deaths annually (20% of all child deaths), 70% in Africa and Asia.² Most countries in Africa and Asia record 2–10 times more children with pneumonia (7–40/100 annually) than in the USA. It may be worth mentioning that the world's two most populous nations, India and China, being part of Asia contribute significantly to these numbers.

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EPIDEMIOLOGY

Limitations of the existing data

Whilst severity of the disease, lack of access to health care and institutional or social factors may be responsible for this high disease burden, little is known about the important epidemiological factors. There are scanty data on the causative agents. Apart from resource constraints and an overburdened health system, another reason for lack of data is the difficulty in defining pneumonia. While the 'gold standard' for defining pneumonia is considered to be a chest X-ray this investigation has limitations due to poor inter and intra-observer reliability. Also because of financial difficulties in Asian countries, chest X-rays are not recommended for routine diagnosis. Most countries use sensitive but less specific World Health Organisation (WHO) definitions (e.g. by age-specific respiratory rates and chest in-drawing) for diagnosing ARI.

Disease burden

The Board on Science and Technology for International Development, US (BOSTID) formed a multinational, multi-centred group of researchers to gather information on ARI in developing countries. They reported 12–17 new episodes of ARI per 100 child-weeks. The rates for acute lower respiratory tract infections (ALRIs) ranged from 0.2–3.4 new episodes per 100 child-weeks. ALRI was defined by the presence of at least one of the following: rales, wheezing, respiratory rate >50/min, cyanosis or chest in-drawing. The definitions usually covered more serious lower respiratory tract infections such as pneumonia and bronchiolitis. The highest infection rates were in children under 2 years of age. In studies in hospitalised children, they reported a clear decrease in admission after 23 months of age suggesting that younger children are likely to develop more frequent and more severe infections.³

Earlier estimates from Bangladesh in the mid 1980s in 1349 children who died, reported ARI in 29%, the leading cause of death.⁴ In a nationwide survey in Bangladesh in 1992, diarrhoea plus ARI accounted for 25.8% of all child deaths. ARI alone was responsible for 15.5% of all child deaths.⁵ In a subsequent study in a large rural community in Bangladesh, Zaman *et al.* reported an ARI incidence of 5.5 episodes per child-year. Of these episodes, 96% were due to upper respiratory infections. The incidence of ALRI was 0.23 per child per year.⁶ In a longitudinal follow up study from coastal India, a similar overall incidence of ARI (6.42 episodes per child per year) was reported. Mean duration of ARI during one year was 32.5 days per child. Most of the ARI episodes (91.3%) were a cough or cold (no pneumonia). However, 8.2% developed pneumonia, many being infants.⁷

RISK FACTORS

Despite the inadequacy of research into the epidemiological causes of pneumonia, certain risk factors have been

identified. In a study from Pakistan, malnutrition (wasting), younger age, low immunisation rate and early childhood respiratory damage were significant factors for the development of pneumonia.⁸ Shah *et al.* reported delayed weaning as well as overcrowding as additional important determinants for pneumonia in India.⁹ Environmental tobacco smoke (ETS) and solid fuel use for cooking have also been recognised as important risk factors.¹⁰ Children living in poor housing with excessive environmental smoke suffered more frequently in India.⁹ These factors, largely manifestations of poverty, were found to be instrumental in Bangladeshi children as well.¹¹ Risk factors that increase the incidence and severity of lower respiratory infection in developing countries include large family size, lateness in the birth order, overcrowding, low birth weight, malnutrition, vitamin A deficiency, lack of breastfeeding, pollution and young age.^{12,13}

The risk factors associated with increased mortality have also been investigated. Children with ALRI who are below 1 year of age, are unable to feed, have loose stools and/or severe malnutrition were found to be at higher risk of death during an acute episode.^{14,15} Co-existing measles also increases mortality.⁶

Low birth weight

It is estimated that approximately 20% of children born in developing countries have birth weights under 2500 g. They are at a higher risk of acute respiratory infections including pneumonia. Neonatal respiratory disease is an important complication in such babies. Low birth weight (LBW) is a major contributor to pneumonia morbidity and mortality. Babies can either be born premature or at term but small (i.e. small for gestational age (SGA)). Unlike in developed countries where most LBW babies are premature, SGA babies form a formidable proportion of LBW babies in developing countries. Reduced immune competence, impaired lung function, short duration of breastfeeding and poor nutritional status perhaps make such babies prone to ALRIs.

In a study from Haryana, India, where a cohort of LBW and normal weight babies was followed for 1 year, the LBWs had eight times higher mortality rates from ALRI. The number and duration of the ALRIs in the two groups was similar.¹⁶

Under-nutrition

Under-nutrition, as assessed by poor weight gain, is very prevalent in the under-fives in the developing world, with 36% of children affected. This has been identified as a contributor to the pneumonia burden in Asia.¹⁷ Malnourished children have an impaired immunological response; consequently they suffer more severe infections. In a prospective community-based study in the Philippines, the children with weight-for-age Z scores of <-2 had a 3.1 higher risk of death due to ALRI.¹⁸ In Bangladesh,

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