Etiology of Community Acquired Pneumonia in Indian Children based on Multiple Biological Specimens and Multiple Analytic Models.

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Background:

- ❖ Childhood Community acquired pneumonia (CAP) is an important public health problem.
- ❖ Traditionally etiology is assigned based on microbiological analysis of naso-pharyngeal (NPA) samples
- ❖ This has several limitations.
- ❖ We sought to determine etiology using multiple biological specimens and multiple analytic models to assign etiology.

Methods:

- ❖ Study design: Prospective cohort
- ❖ Study duration: Jan to Jun 2015
- ❖ Inclusion: Children (1 mo to 12 y) with severe CAP (WHO IMCI criteria).
- ❖ Exclusion: Illness > 7 d, antibiotics > 24 h, immune-deficiency.
- ❖ Sample size: 222 consecutive children.
- ❖ Procedures: Chest radiography, blood culture, and NPA culture & viral PCR.
- ❖ Additional specimens (lung aspirate, broncho-alveolar lavage, pleural fluid, sputum, induced sputum) culture & PCR.
- ❖ Serology for atypical organisms.
- ❖ Etiology assigned in individual children using a hierarchy of biological specimens and analytic models based on weighting potential pathogenicity of individual organisms in biological specimens (Fig 1).

Results:

- ❖ Microbial etiology could be assigned in:
 - 159 (71.6%) with Liberal Model
 - 140 (63.1%) with Intermediate Model
 - 85 (38.3%) with Conservative Model.
- ❖ Viral etiology dominated among those with a single pathogen Irrespective of model.
- ❖ RSV dominant single pathogen in all Models.
- ❖ Distribution of single bacterial species depended on the Model.

	Liberal model	Intermediate model	Conservative model
Direct lung aspirate, Broncho-Alveolar Lavage, Pleural fluid			
Bacteria (culture)	All pathogenic	All pathogenic	All pathogenic
Virus (PCR)	All pathogenic	All pathogenic	All pathogenic
Atypical organism (PCR)	Pathogenic	Pathogenic	Pathogenic
Blood			
Bacteria (culture)	All pathogenic	Not pathogenic: CONS	Not pathogenic: CONS
Sputum, Induced sputum			
Bacteria (culture)	Not: α hem Strept, Diphtheroids	Not: α hem Strept, Diphtheroids	None pathogenic
Virus (PCR)	All pathogenic	All pathogenic	Pathogenic: RSV, HMPV, Flu, PIV
Atypical organism (PCR)	Pathogenic	Pathogenic	Pathogenic
Nasopharyngeal aspirate			
Bacteria	Not: α hem Strept, Diphtheroids	Not: S. pneum, H. influ, M. catar, CONS, Neisseria, α hem Strept, Diphtheroids	None pathogenic
Virus	All pathogenic	All pathogenic	Pathogenic: RSV, HMPV, Flu, PIV
Serology for Atypical organisms			
Positive in duplicate	Pathogenic	Pathogenic	Not pathogenic
Assignment of Microbial etiology			
Etiology	Liberal model	Intermediate model	Conservative model
Bacterial	48 (21.6%)	25 (11.3%)	10 (4.5%)
Viral	65 (29.3%)	85 (38.3%)	68 (30.6%)
Atypical organism	6 (2.7%)	6 (2.7%)	3 (1.4%)
Mixed	40 (18.0%)	24 (10.8%)	4 (1.8%)
Indeterminate	63 (28.4%)	82 (36.9%)	137 (61.7%)

Conclusion:

- ❖ Hierarchical etiology assignment with multiple biological specimens demonstrates that microbial etiology in CAP is predominantly viral.
- ❖ RSV is the single dominant pathogen.
- ❖ Among bacteria, Gram-negative species outnumber Gram-positive organisms.
- ❖ S. pneumoniae does not appear to be as important as suspected.

Clinical & Public health implications:

- ❖ It is impossible to predict etiology in individual children at presentation.
- ❖ Prophylaxis strategies must consider RSV, rather than Pneumococcus alone.
- ❖ Gram-negative bacteria need emphasis.

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