Approach to Identifying Causative Pathogens of Community-Acquired Pneumonia in Children Using Culture, Molecular and Serology Tests.

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Background & Introduction: Pneumonia is the leading infectious cause of death amongst children under 5 years. Viral CAP among children is increasingly recognized but microbiological diagnosis in community-acquired pneumonia (CAP) in children remain a challenge due to non-specificity of clinical and radiographic findings. Empiric antimicrobial therapy is given in CAP but overuse of antibiotics can engender resistance to multiple antibiotic classes as well as toxicity**.** Interpretation of results from routinely collected specimens (blood, sputum, and nasopharyngeal swabs) is complicated by bacterial colonization and prolonged shedding of incidental respiratory viruses. Using current literature on assessment of CAP causes in children, we developed approach for identifying the most likely causative pathogen(s).

ACADEMIC P.E.A.R.L.S

Pediatric Evidence And Research Learning Snippet

Etiological Diagnosis of Pneumonia in Children Using Culture, Molecular and Serology Tests

Proposed Rules to Assess Bacterial Pathogens: Blood culture and whole-blood PCR are considered first-tier due to high specificity, followed by induced sputum culture and molecular testing (PCR) of NP/OP swabs or induced sputum specimens.

•**Blood test:** All organisms detected by **blood culture**, except for contaminants, are considered potential pathogens while any non-contaminant bacteria found by PCR is a potential pathogen.

•**Sputum culture & gram stain** : A good quality specimen defined by <10 squamous epithelium per low-power field (magnification, 100×).

•**Molecular test (PCR**): Nasopharyngeal/Oropharyngeal Swab (NP/OP) and/or induced Sputum- for bacteria not classified as NP colonizer, any positive PCR indicates a pathogen. For bacteria that can be colonizer, higher density is considered indicative of causality - copy number exceeds 6.9 log10 copies/mL for *S. pneumoniae*, 5.9 log10 copies/mL for *H. influenzae*, and 7.5 log10 copies/mL for *S. aureus*.

•**Serologic Test** Paired serum (acute-convalescent) : seroconversion OR 2-4 increase, depending on the test, in antibody titre in the convalescent specimen.

List of non-colonizer bacteria for NP PCR testing: *Mycoplasma pneumoniae, Legionella pneumophila, and Chlamydia pneumonia.*

List of colonizer bacteria for NP PCR testing: *Streptococcus pneumoniae, Haemophilus influenzae, and Staphylococcus aureus.*

Proposed Rules to Assess Viral Pathogens:

•**Molecular test (PCR):** Nasopharyngeal/Oropharyngeal Swab (NP/OP) and/or Induced Sputum :A PCR test with Ct value <40 is considered diagnostic while high viral load (Ct value < 24) are regarded as true pathogens for bystander viruses.

•**Serologic Test :** Paired serum (acute-convalescent) collected at least 7 days apart & 2-4 fold or greater increase in titres between paired serum specimens helpful for diagnosis.

List of viruses well-known to cause pediatric pneumonia*: Respiratory syncytial virus (RSV), Influenza virus (IV), Human metapneumovirus (HMPV), and Human parainfluenza viruses (HPIVs).*

List of innocent bystander viruses*: human Bocavirus (hBoV), Adenovirus (AdV), non-SARS human Coronavirus (hCoV), Enterovirus (EV), and Rhinovirus.*

Conclusion: Identifying bacterial and viral etiologies of pneumonia in children is necessary yet challenging. These rules will support effective clinical management of and research on childhood pneumonia. Our proposed rules are advantageous in their comprehensive approach, which may increase accuracy of diagnosis. This is very useful for research and well-equipped facilities. However, cost and complexity may present barriers in many laboratories and hospitals, limiting feasibility in low-resource settings.

EXPERT COMMENT

“Etiological diagnosis of childhood pneumonia : various methods like cultures, molecular(PCR) serology and antigen testing are helpful but nasopharyngeal coloniser bacteria & innocent bystander respiratory virus may obscure test interpretation. Proposed rules are helpful in correlation with bio markers(e.g. CRP & Procalcitonin) to guide treatment ,reduce the antimicrobial use & resistance.Though cost, availability & complexity of interpretation are challenge in resource limited hospitals in current scenario.”

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With warm regards,

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Reference

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