Sequelae Associated with Pneumococcal Meningitis

Samir K Saha and Meningitis Collaborative Study Group, Bangladesh
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Meningitis in Childhood

• Important cause of morbidity and mortality
  – Case fatality – 11 – 40%
  – Common Cause of Severe Neurological Sequelae

• Prevalent in developing countries – although less appreciated
  – Care seeking
  – Prejudice
  • Supernatural – traditional healers – lumber puncture practice
Sequelae from Meningitis

• Impairment/Disability
  – Limited data and few of them are comprehensive
  • Focused on specific type of sequelae
  • Information are not etiology specific
  • Mostly collected by retrospective chart review
Meningitis in Children: Bangladesh Perspective

• Data available from Bangladesh, 1990s
  – Mortality - >25%
  – Disability – 20%
  – Home death on long term follow up of meningitis cases – 20%

• These data are either for Hib or over all meningitis

• Assessments for sequelae was not comprehensive
Pneumococcal meningitis: Bangladesh Perspective

Prevalence of etiology of meningitis before and after introduction of the Binax NOW ICT for detection of *S. pneumoniae* in CSF in Bangladesh

Prior to Binax 1993 – 2003
(N= 2,410 meningitis cases)

- Pneumococcus: 37%
- Hib: 48%
- Nmen: 9%
- Others: 6%

Post Binax 2004-2007
(N= 464 meningitis cases)

- Pneumococcus: 60%
- Hib: 32%
- Nmen: 5%
- Others: 3%
Pneumococcal meningitis (Jan’06 - Nov’07)

- Few cases are culture positive
- Comparative data of previous years
  - Progressively more culture negative-antigen positive cases
    - Prior antibiotic
- Binax - most sensitive test
Bangladesh study

• Physical and Neuro-developmental assessments of two cohorts
  – Short term – 30-40 days
  – Long term – 6-24 months

• Qualitative impact of pneumococcal meningitis on families
Study Site – Dhaka Shishu Hospital

• Largest Paediatric Hospital
  – Total beds - 470
    • 50% non paying for poor patients
  – Average admission – ~14,000/anum
  – Average out-patients – ~200,000/anum
  – All subspecialties including a “state of art” Child Development Centre
Subjects

- **Included**
  - Laboratory confirmed pneumococcal meningitis cases
    - Culture
    - Latex
    - ICT (Binax)
  - Age 2-59 months

- **Healthy Controls**
  - Age, Sex, SES and area of residence matched
    - Mostly from immunization clinic or coming for cold surgical cases or sibling accompanying the sick baby

- **Excluded**
  - If prior to illness:
    - Seizure disorders
    - Hydrocephalous
    - Recurrent meningitis
    - Hearing loss
    - Developmental delay
    - Mental retardation
    - Head trauma

**POSITIVE**
Pneumococcal Meningitis Cases

Short term group
Enrolled (N=70)

- LAMA (N=4; 6%)
- Referred (N=3; 4%)
- Lost (N=5; 7%)
- Death (N=7; 10%)
  - Hospital (N=5; 7%)
  - Home (N=2; 3%)
- Followed up (N=51)
  (After 30 – 40 days of discharge)

Long term group
Selected (N=70)

- Home Death (N=11; 16%)
- Lost (N=8; 11%)
  (Failed to Locate)
- Followed up (N=51)
  (After 6 – 24 months of discharge)
Multidisciplinary Study Team

- Community Health Workers
  - Home visit
  - Bringing the child to Hospital
  - Qualitative assessment
- Psychologists
- Ophthalmologists
- Neurologists
- Audiologists
- Epidemiologists
- Pediatricians
- Microbiologists
Assessments

- **Physical**
  - Head circumference

- **Neurological**
  - Motor deficit
  - Cranial nerve palsy
  - Hearing (OAE, ABR)
  - Vision
    - Screened
      - for near vision loss, using graded objects
    - Ophthalmologist
Assessments

• Psychological
  – Measurement of IQ
    • Cognitive delay
      – Bayley Scales for Infant Development (BSID; 0-42m), *bangla* adaptation
      – Stanford Binet Intelligence Test (>42m) (non verbal) *bangla* adaptation
  – Adaptive Behavior
    • Independent Behavior Assessment Scale (IBAS) (Developed in Bangladesh)
      – sitting, walking, running etc.
      – Reaching, grasping, drawing, etc.
    • Activities of daily living: Toileting, dressing, eating, etc.
    • Communication, socialization
# Sequelae in Meningitis Cases

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<thead>
<tr>
<th></th>
<th>Neuro-developmental Impairments</th>
<th>Uneventful</th>
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<tbody>
<tr>
<td></td>
<td>Hearing</td>
<td>Vision</td>
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<tr>
<td><strong>Short-term</strong></td>
<td></td>
<td></td>
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<tr>
<td>(n=51)</td>
<td>17 (33%)</td>
<td>4 (8%)</td>
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<tr>
<td><strong>Long-term</strong></td>
<td></td>
<td></td>
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<tr>
<td>(n=51)</td>
<td>9 (18%)</td>
<td>2 (4%)</td>
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<tr>
<td><strong>Control</strong></td>
<td></td>
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<tr>
<td>(n=50)</td>
<td>0</td>
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Qualitative Impact of Pneumococcal Meningitis

• Most of the families are poor with average income $\leq 25/\text{person/month}$
• Average direct cost at hospital $300$
  – Although majority of them were on free bed
• Qualitative impacts multi-dimensional
  – Loan with high interest rate $\sim 120\%$
  – Selling land, cattle, households, etc.
  – Interruption of education of the child and other sibling(s)
  – Separation of parents
    • Abandonment of mother and child
Human Face of Pneumococcal Meningitis

• Contrasting twin Nayeem and Monica
  – 5 months old Nayeem was in DSH for 21 days
  – Survived with devastating consequences
  – Mother stopped working
  – Parents sold their land
  – Sibling could not go to school in time
  – Nayeem died after 16 months
  – Nonetheless, impact of disease episode still remains
What is Added by this Study

• Pneumococcal meningitis is common
  – More than we anticipated
• High prevalence of disability
  – Cognitive delay
  – Psychomotor delay
  – Hearing loss
  • More than expected
    – Multidisciplinary group
    – Prospective and Comprehensive assessment
Disability due to Pneumococcal meningitis: How big the problem is?
Disability: WHO classification

- Bigger impact on Family † Society † National Resources

• Qualitative Impact of Disability: Developed Vs Developing countries
Prevention of Disability: Points to Ponder
Possible Strategies

- Prevention/immunization
  - We have few things to be proud
  - Immunization Program in Bangladesh: a success story e.g. near disappearance of Tetanus, Diphtheria, Polio, etc.

Possible Strategies

- Treatment in time
  - What % of children are coming to a facility?
  - Where most of the children are dying?

- Policy decision
  - Limited Resources and Competitive Priorities
  - GAVI and AMC Solutions