

# **Evaluation of independent predictors of childhood meningitis in routine clinical practice in a malaria endemic area of Papua New Guinea**

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# Introduction

- Acute bacterial meningitis (ABM) remains a major killer disease in developing countries (T. Duke et al).<sup>1</sup>
- Case fatality rate of ABM about 18% in developing countries (WHO).
- Globally, over 75% caused by *Streptococcus pneumoniae*, *Haemophilus Influenzae* and *Neisseria Meningitidis*.<sup>3</sup>
- In PNG, *S pneumoniae* and *H influenzae* are leading causes of ABM, with significant mortality and neurological disability in surviving children (Local studies).<sup>4-6</sup>

# Introduction cont...

- Over-diagnosis of life-threatening childhood infections in severely ill patients is common, due to lack of lab. support <sup>7, 8</sup>
- Developing nations depend more on clinical diagnosis with over prescribing antimicrobial resulting increased risk of drug resistance.<sup>10-16</sup>
- Local study showed 100% chloramphenicol resistant to Hib and 43% pneumococcal resistance reported recently
- This may lead to incorrect reporting and treatment guidelines and health interventions on inaccurate data.

# Aim

Evaluate the usefulness of independent predictors of ABM and to compare the accuracy of a Clinical ward diagnosis of ABM and a laboratory supported diagnosis of ABM.

# Objectives

- To evaluate the usefulness of the predictors of ABM in routine clinical practice and identify challenges that may hamper implementation.
- To compare the accuracy of a ward diagnosis of ABM with the lab diagnosis and identify reasons for discrepancies and possible implications.

# Methodology: Study site and data collection

- Carried out at Modilon General Hospital, Madang Province
- Consisted of 2 separate data
  1. Prospective data – collected from Severe childhood illness study, 2007-2010 clinical predictors of ABM
  2. Retrospective data from Hospital admissions records 2011-12 (same patients)
    - ward admission/discharge record books and patient admission charts for the same population in the prospective group retrieved.
    - Ward clinical diagnosis, and clinical predictors of ABM recorded in a Excel spread sheet for comparison and matched for analysis.

# Design/analysis

- The study was a blinded retrospective analysis of a well-defined prospective data
- This study design was chosen to compare a laboratory-supported research diagnosis of ABM against a provisional clinical ward diagnosis of ABM.
- Blinding and use of a ward clinical diagnosis instead of the final diagnosis was used to limit bias.
- STATA program (version 11) was used for data analysis.

# Sample size/Ethical approval

- Samples size not based on any samples size calculation
- Approved by Modilon General Hospital Management/Research committee for Retrospective Data collection
- and PNGIMR Institutional Review Board and PNG Medical Research Advisory Committee (MRAC number 07.37).

# Clinical predictors of ABM

## Positively predictive

- Young age < 18 months
- Neck stiffness
- Kernig's sign
- Deep coma
- Multiple convulsions
- Bulging fontanel

## Negatively Predictive

- Single convulsion
- Blood slide positive malaria

# Case Definition of ABM

- Based on Local Studies<sup>6, 14, 18, 20</sup>

## ***1. Proven acute bacterial meningitis***

A sick child with a positive CSF or blood culture,

## ***2. Probable acute bacterial meningitis***

A sick child with meningism and/or impaired consciousness and multiple seizures, CSF WCC  $\geq 20$  cells/ $\mu$ L.

## ***3. Not acute bacterial meningitis***

Unsupported clinical and laboratory diagnosis of meningitis.

# Inclusion/Exclusion

## Prospective

Children eligible for inclusion:

- between 2 months to 10 years
- admitted to Modilon hospital between September 2007 and June 2010, and
- received lumbar puncture

Those did not fulfill were excluded.

## Retrospective

Children eligible for inclusion :

- name, age and date of admission matched prospective dataset and,
- clinical ward diagnosis recorded.

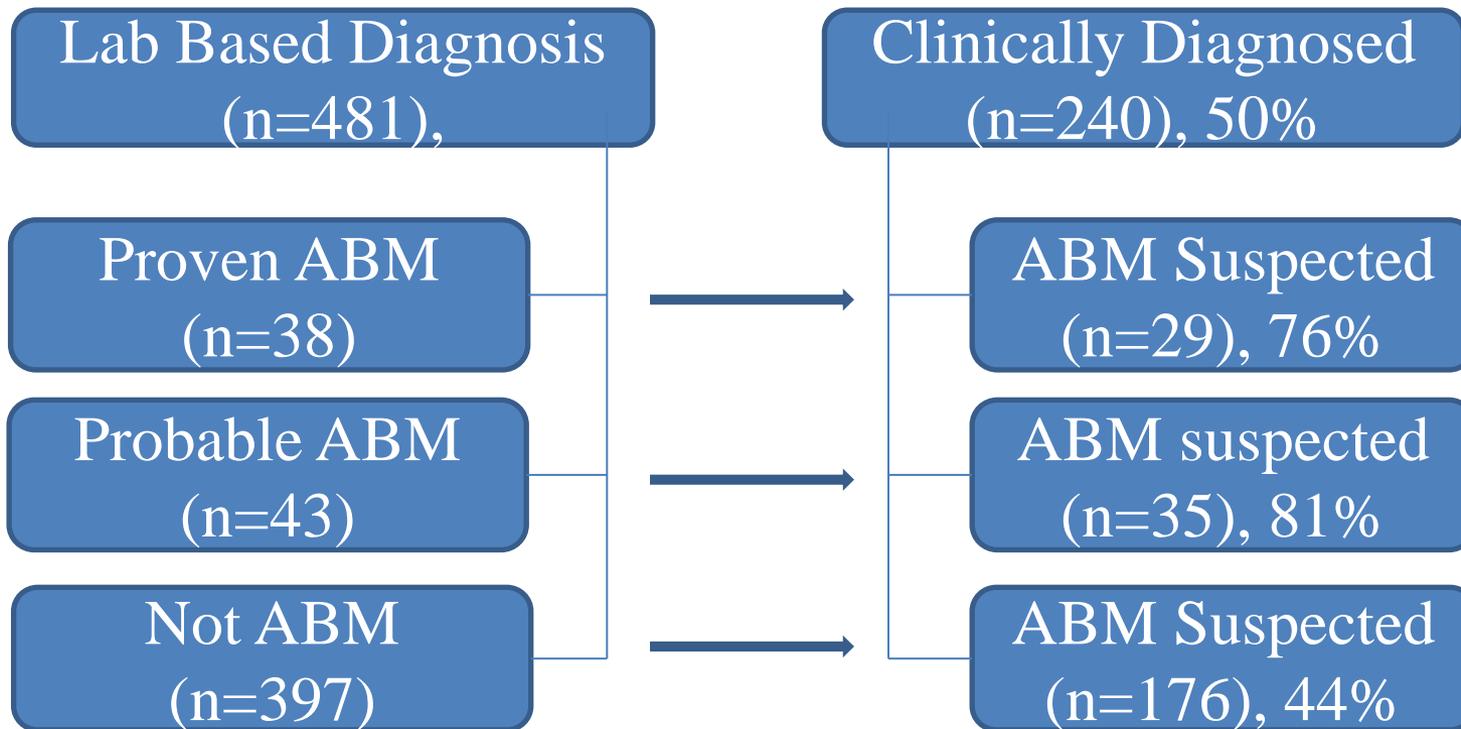
Those did not fulfill were excluded.

# Results

- 554 participants in the prospective study,
- 87% (481) charts were retrospectively retrieved.
- 13% (74) admission charts missing or incomplete data.
- 56% males with median age 26 months (95% CI 24-33)
- 50% (240) of these children were clinically suspected as having ABM.
- 17% (81) diagnosed laboratorically

# Results cont...

**Figure 1:** Proportion of Laboratory-confirmed proven and probable ABM cases who were correctly identified clinically. Data are in numbers (percent).



**Table 2: Comparing Clinical and Laboratory based ABM Diagnosed**

Predictors	Association	Clinically diagnosed ABM (n= 240)	Lab. confirmed ABM (n=81)	P Value
Age (Years)	< 1	91	33	0.328
	1-5	101	29	
	>5	48	19	
Neck stiffness	Yes	90	61	0.441
	No	150	19	
Kernig's sign	Yes	35	32	0.717
	No	201	45	
Deep coma	Yes	51	27	0.054
	No	180	54	
Single convulsion	Yes	68	11	0.390
	No	168	70	
Multiple convulsion	Yes	83	35	0.390
	No	153	46	
Bulging fontanel	Yes	11	10	0.005
	No	98	29	
Positive malaria	Yes	41	1	0.017
	No	116	63	

# Discussion

- This study showed two important findings:
  1. - Though algorithm was predictive in identifying ABM, Basic Lab support must be maintained for it to be effective.
    - without basic laboratory support, despite a high index of clinical suspicion for ABM in our setting, about 20-25% of children with ABM would still be missed.
  2. that without a standardised method of establishing a diagnosis in a ward setting, important clinical signs would still be missed.

## Discussion: cont...

- significant difference between a clinical and final laboratory diagnosis of ABM (240/481 versus 81/481,  $p < 0.001$ ). **Lab. Base ABM 17% while Clinical Based ABM 50%.**
- Overall using the independent predictors of ABM identified 76% of children with proven ABM and 81% of those with probable ABM.
- With a positive malaria slide, likelihood of having ABM is significantly low. <sup>6,25</sup>

# Conclusion

- this indicates that diagnostic guidelines, such as predictors of ABM is important tool to establish clinical diagnosis of ABM.
- Maintenance and improved basic Laboratory services for CSF/Blood cultures and malarial microscopy may significantly improve diagnosis.
- Resulting accurate documentation of illnesses, improve patient-care and in a wider context, provide accurate information to policy makers in order to monitor and control diseases in-country and assist in health sector planning.

# Limitations

1. Missing records of 73 eligible; sample size of 481 children was adequate.
2. Missed document of some clinical signs from ward admission charts
3. 20-25% of Laboratory confirmed but clinically missed diagnosed may be an underestimation. Lab. Results made known immediately, may have influenced clinical diagnosis

# Recommendations

1. Inco-operate more standardised method of establishing clinical diagnosis such as Predictors of ABM needed in the PNG Health settings
2. Improve and maintain basic laboratory services (Blood/CSF cultures and malaria microscopy) in PNG hospitals.

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