Melioidosis in the heart of Borneo

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A single-centre retrospective study and identification of predictors of mortality

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Introduction

Melioidosis is a fatal disease caused by *Burkholderia pseudomallei*, found in contaminated soil and surface water.

Its multi-faceted presentations is due to the diverse mode of transmission, including droplet inhalation, skin inoculation and ingestion.

Due to its inherent resistance to many first-line antibiotics, melioidosis remains a burden of disease in resource-limited environments.
Mortality of culture-proven melioidosis across Southeast Asia and Australia

Mortality 17% (Chrispal et al, 2009)
Mortality 14% (Currie et al, 2010)
Mortality 35% (Soawapak et al, 2018)
Mortality 18.4% (Pang et al, 2018)
Mortality 12.3%
Mortality 43% (Kingsley et al, 2016)
Kelantan 33% (Zueter et al, 2016)
Kedah 34% (Hassan et al, 2010)
Pahang 54% (How et al, 2005)
Johor 48% (Pagalavan, 2005)

Mortality 33%
(Mortality 34% (Hassan et al, 2010)
Pahang 54% (How et al, 2005)
Johor 48% (Pagalavan, 2005)
Objectives

To delineate the epidemiological, clinical and microbiological characteristics of 65 adult patients with culture-confirmed melioidosis over a 30-month period from July 2016 to December 2018

To identify the predictors of mortality among patients with culture-confirmed melioidosis
Of the 65 patients, 71% were male and the majority were of Iban ethnicity. Melioidosis affects mainly the middle-aged population.
Hypertension is the only risk factor that was found to be significantly associated with mortality.
(a) Percentage of isolates from clinical specimens

(b) Sensitivity tests against commonly used antibiotics

- **Ceftazidime**
  - Tested: 51
  - Sensitive: 51
  - Resistant: 0
  - Percentage (%): 100

- **Gentamicin**
  - Tested: 36
  - Sensitive: 34
  - Resistant: 2
  - Percentage (%): 94.4

- **Augmentin**
  - Tested: 51
  - Sensitive: 48
  - Resistant: 3
  - Percentage (%): 94.1

- **Bactrim**
  - Tested: 58
  - Sensitive: 37
  - Resistant: 21
  - Percentage (%): 63.8

(c) Time from admission to initiation of anti-melioidosis treatment

Positive cultures largely came from blood (49%; n=41) and respiratory secretions (28%; n=23).

Mean time from admission to initiation of anti-melioidosis treatment is **2.7 days**.
Blood stream infection, pneumonia and internal organ abscesses usually present on the fulminant end of the spectrum, with a high rate of septic shock and mortality.
UNIVARIATE ANALYSIS OF PREDICTORS OF MORTALITY IN 65 PATIENTS WITH CULTURE POSITIVE MELIOIDOSIS

### Clinical features

<table>
<thead>
<tr>
<th>Clinical features</th>
<th>Total patients (n = 65)</th>
<th>Dead (n = 8)</th>
<th>Alive (n = 57)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pneumonia</td>
<td>41</td>
<td>6</td>
<td>35</td>
<td>0.372</td>
</tr>
<tr>
<td>Bacteraemia</td>
<td>43</td>
<td>7</td>
<td>36</td>
<td>0.169</td>
</tr>
<tr>
<td>Liver / splenic abscess</td>
<td>34</td>
<td>3</td>
<td>31</td>
<td>0.303</td>
</tr>
<tr>
<td>Septic arthritis</td>
<td>5</td>
<td>0</td>
<td>5</td>
<td>0.507</td>
</tr>
<tr>
<td>Soft tissue abscesses</td>
<td>9</td>
<td>0</td>
<td>9</td>
<td>0.583</td>
</tr>
<tr>
<td>Ocular</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>0.670</td>
</tr>
<tr>
<td>Cerebral</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0.877</td>
</tr>
<tr>
<td>Septic shock</td>
<td>24</td>
<td>7</td>
<td>17</td>
<td>0.003**</td>
</tr>
<tr>
<td>Mechanical ventilation</td>
<td>21</td>
<td>8</td>
<td>13</td>
<td>0.000***</td>
</tr>
<tr>
<td>ICU admission</td>
<td>26</td>
<td>8</td>
<td>18</td>
<td>0.000***</td>
</tr>
</tbody>
</table>

*Statistical significance was measured by chi-square test.  
* p < 0.05  ** p < 0.01  *** p < 0.001

### Blood investigations upon admission

<table>
<thead>
<tr>
<th>Blood investigations upon admission</th>
<th>Total mean (n = 65)</th>
<th>Dead mean (n = 8)</th>
<th>Alive mean (n = 57)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>7.443</td>
<td>7.432</td>
<td>7.444</td>
<td>0.764</td>
</tr>
<tr>
<td>Serum bicarbonate (mmol/L)</td>
<td>20.3</td>
<td>16.5</td>
<td>20.8</td>
<td>0.001***</td>
</tr>
<tr>
<td>Serum sodium (mmol/L)</td>
<td>126</td>
<td>125</td>
<td>127</td>
<td>0.428</td>
</tr>
<tr>
<td>Serum potassium (mmol/L)</td>
<td>3.7</td>
<td>4.1</td>
<td>3.7</td>
<td>0.114</td>
</tr>
<tr>
<td>Serum urea (mmol/L)</td>
<td>7.6</td>
<td>16.5</td>
<td>6.3</td>
<td>0.000***</td>
</tr>
<tr>
<td>Serum creatinine (mmol/L)</td>
<td>148</td>
<td>321</td>
<td>122</td>
<td>0.000***</td>
</tr>
<tr>
<td>Aspartate transaminase (U/L)</td>
<td>128</td>
<td>267</td>
<td>110</td>
<td>0.025*</td>
</tr>
<tr>
<td>Alanine aminotransferase (U/L)</td>
<td>97</td>
<td>136</td>
<td>92</td>
<td>0.355</td>
</tr>
<tr>
<td>Serum albumin (g/L)</td>
<td>34</td>
<td>30</td>
<td>34</td>
<td>0.016*</td>
</tr>
</tbody>
</table>

*Statistical significance was measured by Student’s t-test.  
* p < 0.05  ** p < 0.01  *** p < 0.001

Septic shock, mechanical ventilation, intensive care unit admission, serum urea, serum creatinine, serum bicarbonate, serum aspartate aminotransferase and serum albumin are associated with an increased risk of mortality.
MULTIVARIATE LOGISTIC REGRESSION ANALYSIS OF PREDICTORS OF MORTALITY IN 65 PATIENTS WITH CULTURE POSITIVE MELIOIDOSIS

(a) Mortality against serum bicarbonate

For every mmol/L decrease in serum bicarbonate, there is an increase in the mortality by 9%.

(b) Mortality against serum albumin

For every g/dL decrease in serum albumin, there is an increase in the mortality by 6%.

Serum bicarbonate and serum albumin are independent predictors of mortality.

For every mmol/L decrease in serum bicarbonate, there is an increase in the mortality by 9%.

For every g/dL decrease in serum albumin, there is an increase in the mortality by 6%.
Summary

1. Over a 30-month period, 65 adult patients were recruited in the study with a median age of 45 years. 75\% were male and majority were of Iban ethnicity.

2. Positive cultures largely come from blood and respiratory secretions. All are sensitive to Ceftazidime and 94.4\% to Gentamicin. Mean time from admission to initiation of anti-melioidosis treatment is 2.7 days.

3. Blood stream infection, pneumonia and internal organ abscesses usually presents on the fulminant end of the spectrum, with a high rate of septic shock and mortality. Total mortality is 12.3\%.

4. Hypertension, septic shock, mechanical ventilation, intensive care unit admission, serum urea, serum creatinine, serum bicarbonate, serum aspartate aminotransferase and serum albumin are associated with an increased risk of mortality.

5. Using the multivariate logistic regression analysis, serum bicarbonate and serum albumin are independent predictors of mortality.
WHAT'S NEXT?

PUBLIC HEALTH IMPACT:
• To identify hot spots for melioidosis and ensure adequate safety measures for workers / farmers

ENVIRONMENTAL IMPACT:
• To sample soil and water in hot spots for melioidosis and explore eradication strategies

CLINICAL IMPACT:
• Early identification of ill patients and initiation of anti-melioidosis treatment

FUTURE RESEARCH:
• To produce a score that predicts mortality in melioidosis
• To identify avenues to reduce mortality
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References


