Detection of a Cluster of Nontuberculous Mycobacteria at a Tuberculosis Hospital: A Quality Assurance Intervention

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Abstract

Background: Nontuberculous mycobacteria (NTM) are acid fast positive bacilli which include over 150 species and are widely distributed in soil and water. The Texas Center for Infectious Disease (TCID), a hospital for patients with confirmed tuberculosis (TB) and San Antonio Metropolitan Health (SAM), a clinic serving patients with suspected or confirmed TB share the same water supply. After a cluster of isolates of Mycobacterium gordonae var. intermedium from patients at TCID, a quality assurance intervention reviewed the protocols for both TCID and SAM.

Methods: All sputa collected for AFB culture from diagnosed TB patients at TCID and SAM during 2014 were included. Sputum samples were processed at the Texas Department of State Health Services (DSHS) Laboratory. Genotyping was performed on available M.gordonae isolates to ascertain relatedness.

Results and Findings: A total of 201 sputa were isolated from 156 patients. 188 (93.8%) from TCID and 75 (37.26%) from SAM. One (0.58%) and 4 (0.53%) from TCID and SAM respectively were contaminated. Only NTM grew from 55 (30.7%) and 10 (21.4%) from TCID and SAM respectively. M. gordonae accounted for 38 of 55 (68.14%) of the NTM at TCID and only 1 of 21 (4.76%) at SAM. No patients had evidence of NTM disease. Review of protocols identified breaches during sputum and drinking water collection, delays in transport to lab which may have increased the recovery of NTM. Sterile water was not used to rinse the mouth prior to sputum collection. A separate protocol for induced sputa is present.

Conclusions: Neither the hospital nor the clinic had adequate protocols. A breach at TCID accounted for the occurrence of the cluster in the hospital.

Introduction

• NTM are acid fast positive bacilli which include over 150 species and are widely distributed in soil and water.
• NTM can colonize pulmonary systems and may colonize the lungs without causing disease.
• Although drinking water, including bottled water, is usually treated, NTM are resistant to some disinfection methods resulting in selection and overgrowth and are a regulated contaminant.
• Pathogenicity of NTM varies depending on the species and host characteristics.
• Coincidental isolation or contamination of diagnostic samples may also occur.
• NTM are often resistant to first and second line TB drugs when tested at the MTB critical test concentration; NTMB/TMB mixes may yield false resistance.
• MTB/NTM mixes are difficult to separate purely so valid MTB can be tested.
• The isolation of NTM may therefore pose a diagnostic and management problem for a clinician managing patients with suspected or confirmed tuberculosis.

Sputum Collection Protocols

TCID: Sputum specimens are collected on weekdays mostly unobserved starting at 9am. Patients are given instruction to breathe deeply to loosen secretions, cough forceful and expectorate into container. Patients are instructed not to drink liquids (including water) prior to sputum collection. Specimens less than 3ml or mainly containing saliva are discarded. Specimens are transported to lab within 2 hours or refrigerated. A separate protocol for induced sputa is present.

SAM: Collection of first sputum specimen is observed and the remaining two specimens are collected at home, unoberved. No other written protocol or instructions are present for sputa collection although verbal advice is provided to the patients.

Comparison of DSHS, TCID and SAM AFB Culture Results

<table>
<thead>
<tr>
<th>Laboratory</th>
<th>Patient Type</th>
<th>2014</th>
<th>Percent Contaminated</th>
<th>Test Positive</th>
<th>Isolated M. gordonae</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSHS</td>
<td>All</td>
<td>765</td>
<td>5.18%</td>
<td>21 (2.75%)</td>
<td>11 (52.38%)</td>
</tr>
<tr>
<td>TCID</td>
<td>All</td>
<td>196</td>
<td>1.08%</td>
<td>1 (0.52%)</td>
<td>1 (100%)</td>
</tr>
<tr>
<td>SAM</td>
<td>All</td>
<td>12169</td>
<td>65.79%</td>
<td>1216 (5.12%)</td>
<td>24 (19.91%)</td>
</tr>
</tbody>
</table>

PFGE of M. gordonae Isolates

• The percentage of contaminated sputa was lower at TCID and SAM than the DSHS Laboratory average of 1.3%.
• Only NTM grew from 55 specimens of 1288 (4.27%) at TCID.
• Only NTM grew from 21 specimens of 765 (2.75%) at SAM.
• M. gordonae was the predominant NTM accounting for 28 of 55 (50.91%) of the isolates at TCID.
• Sputa were not labeled as natural vs. induced at TCID.
• Out of 21 sputa that grew only NTM, SAM, 3 were induced.

A subset of 8 of 20 M. gordonae isolates underwent testing by PFGE; two clinical isolates were found which were unique from the 2 control strains and the American Type Culture Collection Type Strain (ATCC) strain.

PFGE

• Protocol at TCID was in place but not followed and there was no written protocol at SAM.
• Sterile water was not used to rinse the mouth by neither the hospital nor the clinic.
• None of the patients had disease due to NTM.

References


Discussion

• Among the subset of M. gordonae tested by PFGE two clinical strains were found which may reflect the presence of at least two different strains in the water. Further testing of the 12 out of 20 remaining isolates by PFGE is currently in process to assess for the presence of other strains.
• A breach in protocol possibly occurred. We were alerted that the patients may have drank water prior to sputa collection. Patients often drink bottled water at TCID and this is unregulated for NTM. This may have been responsible for the spike in M. gordonae isolates.
• In spite of possible increased isolation of NTM in San Antonio, we found overall low contamination rates and NTM recovery from specimens compared to other Texas provices.
• A modified (lower LANaOH) process for decontamination of specimens that arrive to the lab within 24 to 48 hours can be considered.
• A courier to allow health clinics throughout Texas to get specimens sent overnight and improve transit time would decrease the contamination rate.
• Rinsing the mouth with sterile saline prior to sputum collection in areas where tap or bottled water contain NTM is recommended, as per lab protocols.
• To further reduce contamination and decrease isolation of rarely pathogenic NTM.

Conclusion

• Failure to label the sputa correctly hampered our ability to evaluate contamination.
• Hospital protocol should be designed to avoid features that foster growth of NTM and other organisms.
• Construction of TCID was completed in 2010 and plumbing is unlikely to be the cause of the cluster of M. gordonae.
• Based on GAP sequencing it was assumed that all M. gordonae isolates would be identical but there is only a subset of 8 of 20 further testing performed by PFGE.
• It was found that one of six respiratory technicians at TCID collected 20 of 21 sputa that grew M. gordonae between September through December 2014 and collected all 11 sputa which grew M. gordonae on 9/28 and 9/29. This was likely related to a variance in procedure; however, the documentation was inadequate to explain this.
• A 2% final NaOH concentration is used to decontaminate all specimens at DSHS Laboratory which is at the upper limit of what is recommended.