Reduction Tuberculosis Detection Costs*

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Use of sputum culture for diagnosis of tuberculosis is an inefficient detection technique in a disease of declining prevalence. We found such testing at our 400 bed acute care hospital resulted in less than 2 percent positive when done with prior patient screening. In an effort to minimize detection costs, restrictions requiring that a tuberculin skin test and chest roentgenogram be performed prior to processing the MTB culture were instituted. This resulted in 672 fewer cultures being processed in the trial year, a significant (44 percent) reduction compared to the prior year. At $50.00 per culture, this represents an annual savings of more than $30,000.

Despite declining national prevalence, tuberculosis remains a significant problem with over 27,000 new cases reported annually. This decline contributes to the difficulty of diagnosis, both because of a physician population increasingly unacquainted with the disease and the statistical phenomenon of decreasing sensitivity of a test in a population of low prevalence. This makes high-cost, indiscriminate laboratory screening prohibitive in terms of cost effectiveness. In a previous appraisal of the situation, we concluded that culture of sputum for Mycobacterium tuberculosis (MTB) was being used as a screening tool rather than one of the final, definitive diagnosis. Our analysis revealed that portions of the diagnostic process, specifically skin testing, were being bypassed in favor of the more expensive MTB culture. In one year, this resulted in performance of over 3,200 MTB cultures with only 56 positive results. Our analysis suggested that restrictions placed on the processing of the MTB cultures should decrease detection costs without hindering the diagnostic process.

MATERIAL AND METHODS

The records of the Microbiology Lab at the Albuquerque Veterans Hospital have been on computer file since 1977, affording immediate access and prompt review of past culture results and requests. In April 1979, MTB culture request forms were overprinted, requesting that a tuberculin skin test and chest roentgenogram be performed and results reported on the form prior to the processing of the specimen. Abnormal results of the skin test or roentgenogram were not required for processing. Specimens submitted without this information were not processed until the information was supplied. The request form, however, was returned to the requesting physician; with a sufficient explanation, specimens were processed without requested data.

The time period April 1978, to March 1979, was used as the control period with the required, overprinted form in use from April 1979, to March 1980. Monthly culture requests and results were obtained via the computer and analyzed in respect to the number of cultures generated. These results were tabulated and comparisons made between the two time periods. Follow-up was conducted during the year after the required overprint request form was initiated on all newly diagnosed active (culture positive) cases to determine if the restriction impeded early diagnosis and treatment. Data obtained were analyzed using the Student’s t-test and chi-square test.

RESULTS

The number of MTB cultures generated in the control and restricted periods are shown in Figure 1 and Table 1. There were a total of 672 (44 percent) fewer cultures processed during the time period when the overprinted culture request forms were in use. Although there was fluctuation from month to month, the monthly usage (Fig 1) was decreased in almost all months after the first month initiating the study. As seen in Table 1, there was both a reduction in ordering (33 percent fewer patients; 24 percent fewer cultures), and a further reduction in specimens processed (48 percent fewer patients; 44 percent fewer cultures), the latter difference significant at p<0.001. Of the 672 fewer cultures, 307 were culture requests which were not approved because they did not meet the criteria as

Figure 1. Monthly comparison of the number of MTB cultures performed in the laboratory during control year (no restrictions) vs trial year (required tuberculin testing and roentgenogram).
Table 1—Comparison of Cultures Generated in Control and Trial Years

<table>
<thead>
<tr>
<th>Total Requests for Culture</th>
<th>Restricted Period</th>
<th>Number Approved and Processed</th>
<th>Reduction in Number Requested (%)</th>
<th>Reduction in Number Processed (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Period</td>
<td>Restricted Period</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patients</td>
<td>629</td>
<td>422</td>
<td>396 (207) (33)</td>
<td>303 (48)</td>
</tr>
<tr>
<td>Cultures</td>
<td>1,540</td>
<td>1,175</td>
<td>868 (365) (24)</td>
<td>672 (44)</td>
</tr>
<tr>
<td>Average number samples/patient</td>
<td>2.4</td>
<td>2.8</td>
<td>2.6</td>
<td></td>
</tr>
<tr>
<td>Number (%) positive Patients</td>
<td>12 (1.9)</td>
<td>9 (2.8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cultures</td>
<td>33 (2.1)</td>
<td>20 (2.3)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

previously outlined. During the study year, there was an 8 percent decrease in total hospitalized patients, a decline which was insufficient to account for the drop in MTB culture usage. During each year of study, more than 90 percent of MTB culture requests have emanated from the inpatient services of the hospital.

As outlined in Table 1, 422 patients, as evidenced by the culture request, were considered by their ordering physicians to be potentially tuberculosis infected. This represents a reduction in the pool of patients to be tested by 207 compared to the previous year. This reduction increased the sensitivity of the MTB tests, both for total patients (1.9 percent vs 2.8 percent) and for total culture (2.1 percent vs 2.3 percent), although these increases in detection percentages were not statistically significant.

A review of the charts of the tuberculosis infected patients (defined as those with a positive culture or acid-fast smear) revealed that diagnosis and treatment were not delayed or withheld because of the restrictions placed on the processing of the MTB specimen. We are not aware of any undiagnosed cases of tuberculosis because of this system. Moreover, it was strongly felt, though not rigorously tested, that more tuberculin skin testing was conducted during the study year.

DISCUSSION

Costs of the clinical laboratory contribute significantly to the expense of patient care and hospitalization. Laboratory costs have been found to average 25 percent of the total hospital bill but can comprise as much as 63 percent of a hospitalization. Laboratorv usage has the greatest potential for cost reduction as it is physician initiated and affords an element of both physician and laboratory control.

There have been a number of reports in the literature documenting various strategies of cost reduction. These have included educational methods, test number restrictions, financial incentives, audits, and chart reviews. All have reported variable success with the most successful efforts linking their strategies with some form of active intervention. Usually this has involved concurrent chart review involving attending staff. While less direct, the overprinted MTB culture request was instituted in an effort to be both educational (emphasizing the importance of the skin test and roentgenogram in tuberculosis detection) and to allow the laboratory to play an active role in tuberculosis detection and cost reduction.

Both in the study year and the subsequent year, all newly diagnosed cases of culture-positive tuberculosis were reviewed. No apparent delay in diagnosis or therapy could be found. Since the population of this VA hospital tends to return to this facility for all their health care, we do not believe we missed cases which were subsequently diagnosed elsewhere.

The restrictions produced two important results. First, the restrictions produced a reduction in the patient population for whom physicians wanted cultures, as seen in Table 1, with an increase in detection rate. This effect most likely represented both a better work-up of the patient, with some excluding by virtue of negative findings on screening x-ray films and skin tests, as well as the “stumbling block” effect of decreased use engendered by a required preliminary step. Presumably, this enforced a more logical sequence of patient work-up and discouraged obtaining an MTB culture “for the record.” Certainly, this change in ordering pattern in part represents cases in which the clinical diagnosis became clear during work-up, precluding tuberculosis. That more patients had tuberculin skin tests conducted was the informal consensus of the ward nurse supervisors. By reducing the patient tuberculosis pool and increasing their potential yield, the cultures obtained would predictably have a higher sensitivity. This was seen in our experience by a rise in the percentage of positive cultures per patient from 1.9 percent to 2.8 percent.

Second, the total number of cultures generated were reduced, as outlined in Table 1, resulting in a significant dollar saving. This was the result of both a decrease in the total number of tests requested compared to the previous year (365 cultures or 24 percent), as well as a decrease comprised of cultures which were not processed (307). The 672 fewer cultures generated represent a 44 percent reduction from the previous.
year. At an average cost of $50 per MTB culture, this represents a saving of $33,600 ($50 x 672) over the year. By emphasizing the use of skin testing and chest roentgenograms prior to ordering of the MTB culture, and by changing ordering patterns, use of the laboratory should become more discriminating. These premises have been verified by our experience both in number of cultures processed and in the number of patients considered to have tuberculosis. This, in turn, has led to substantial savings in laboratory and hospitalization costs.

REFERENCES
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