



“Comparison of Diagnostic Yield of Induced Sputum Using 3% Hypertonic Saline Nebulisation Vs 7% Hypertonic Saline Nebulisation in Presumptive Pulmonary Tuberculosis”

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(Received: 16 September 2024

Revised: 11 October 2024

Accepted: 04 November 2024)

KEYWORDS

Presumptive pulmonary tuberculosis, Sputum Induction, Hypertonic Saline nebulisation, Ziehl-Neelsen Staining, CBNAAT.

ABSTRACT:

Presumptive pulmonary tuberculosis is a major diagnostic challenge in global health, especially in regions with high disease prevalence rate and limited healthcare resources. Highlighting the need for precise and timely diagnosis to effectively manage and control the spread of disease [1]. In settings where advanced diagnostic tools are limited, induced sputum examination becomes crucial. This method helps collect respiratory samples from people who can't expectorate sputum spontaneously, thereby facilitating the detection of Mycobacterium tuberculosis, the causative agent of tuberculosis[2]. Hypertonic saline nebulization is most widely utilised technique to induce sputum. By inhaling a hypertonic saline solution, patients can efficiently mobilize secretions from the lower respiratory tract, thus streamlining the collection of sputum samples for diagnostic evaluation[3]. Despite its widespread application, a consensus regarding the optimal concentration of hypertonic saline for sputum induction in presumptive TB cases remains elusive.

INTRODUCTION

Presumptive tuberculosis defines individuals showing symptoms indicative of TB infection but haven't been definitively diagnosed through laboratory tests. These symptoms typically include cough lasting more than two weeks, fever, night sweats, weight loss, or chest X-ray findings that suggest tuberculosis. People with known exposure to active tuberculosis, or those with risk factors like HIV, immunosuppression, or living in tuberculosis-endemic areas, are also categorized as presumptive tuberculosis cases [4].

This study aims to compare the Diagnostic yield of two different hypertonic saline concentrations—3% and 7%—for inducing sputum in Presumptive tuberculosis Patients.

MATERIALS AND METHODS

Study Design

A cross-sectional study was conducted over a period of 18 months at a tertiary care hospital. The study included 104 patients of all age groups who were admitted with suspicion of Tuberculosis.

Inclusion Criteria

1. Patients with symptoms suggestive of Tuberculosis.
2. Both genders.
3. All age groups.
4. Sputum not produced or negative for AFB in two samples, with chest radiograph showing active Tuberculosis according to RNTCP guidelines.

Exclusion Criteria

1. Patients with uncontrolled asthma or chronic obstructive pulmonary disease.



2. Active hemoptysis.

Data Collection

sputum Induction: All the subject's are advised for Sputum induced with precautions using 3% and 7% hypertonic saline nebulisation separately and collected into sterile containers and processed for Zn Staining and observed for Acid fast TB bacilli under light Microscope.

Statistical Analysis

Data were analysed using SPSS version 25. Correlation coefficients were calculated to assess the Diagnostic yield of Induced sputum using 3% vs 7% hypertonic saline nebulisation in presumptive tuberculosis patients. A p-value of <0.70 was considered statistically significant.

RESULTS**Demographic and Clinical Characteristics of study population**

The study population comprised 104 patients, with a mean age group is 49 years. There were 67 males (64%) and 37 females (36%). Occupational Diversity among presumptive Pulmonary Tuberculosis patients most common being homemakers 17 patients (16%). Previous Tuberculosis being most common history in presumptive tuberculosis who compromised 45 patients (43%). Patient's presenting with Tuberculosis Contact History being 39 patients (37.5%). Tuberculosis was diagnosed in 64 patients (62.5%) by inducing sputum using 3% and 7% hypertonic saline nebulisation combined.

TABLE 1: Comparative Analysis of Induced Sputum Acid-Fast Bacilli Results Using 3% vs. 7% Hypertonic Saline Nebulization in Presumptive Pulmonary Tuberculosis Patients.

| INDUCED SPUTUM AFB | 7% NACL (SODIUM CHLORIDE) NUMBER OF PATIENTS (n=104) | 7% NACL (SODIUM CHLORIDE) PERCENTAGE OF PATIENTS 100% | 3% NACL (SODIUM CHLORIDE) NUMBER OF PATIENTS (n=104) | 3% NACL (SODIUM CHLORIDE) PERCENTAGE OF PATIENTS 100% |
|--------------------|--|---|--|---|
| POSITIVE | 38 | 37.5 | 26 | 25 |
| NEGATIVE | 66 | 62.5 | 78 | 75 |
| TOTAL | 104 | 100% | 104 | 100% |

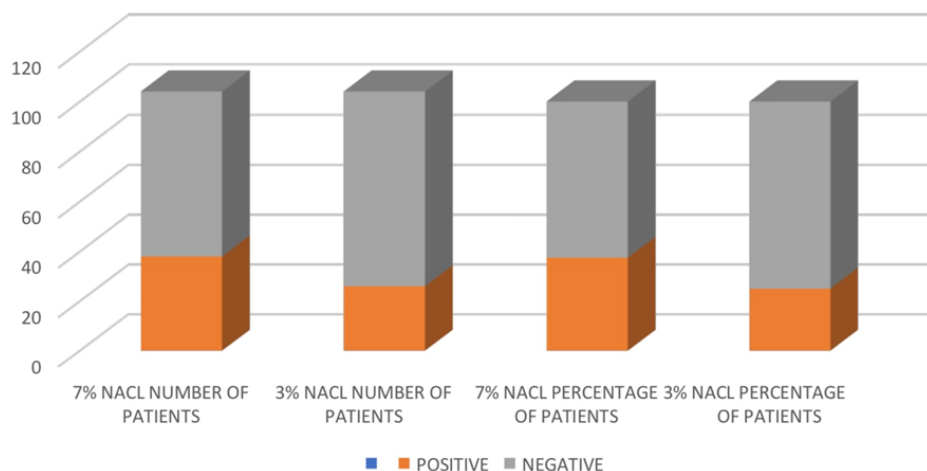


Figure 1: Comparative Analysis of Induced Sputum Acid-Fast Bacilli Results Using 3% vs. 7% Hypertonic Saline Nebulization in Presumptive Pulmonary Tuberculosis Patients.

Table 2: Statistical Analysis of Induced Sputum Acid-Fast Bacilli Results Using 3% vs. 7% Hypertonic Saline Nebulization in Presumptive Pulmonary Tuberculosis Patients.

| PARAMETER | 7% NaCl (SODIUM CHLORIDE) | 3% NaCl (SODIUM CHLORIDE) |
|-------------------------|---------------------------|---------------------------|
| Mean | 1.625 | 1.75 |
| Standard Error | 0.047702 | 0.04267 |
| Median | 2 | 2 |
| Mode | 2 | 2 |
| Standard Deviation | 0.486467 | 0.43511 |
| Sample Variance | 0.23665 | 0.18932 |
| Range | 1 | 1 |
| Confidence Level[95.0%] | 0.094606 | 0.08462 |
| P value | 0.58 | |

DISCUSSION

The induced sputum acid-fast bacilli (AFB) test results among the 104 presumptive pulmonary tuberculosis patients indicate variations based on the concentration of sodium chloride (NaCl) used for nebulization. When a 7% NaCl solution was used, 38 patients (37.5%) tested positive, whereas 26 patients (25%) tested positive with a 3% NaCl solution. The negative results were higher with the 3% NaCl solution, with 78 patients (75%)

testing negative, compared to 66 patients (62.5%) with the 7% NaCl solution. These findings suggest that a higher concentration of NaCl may enhance the detection rate of AFB in induced sputum samples, which has implications for optimizing diagnostic protocols.

The parameters compared between 7% NaCl (Sodium Chloride) and 3% NaCl (Sodium Chloride) solutions are as follows: the mean was 1.625 for 7% NaCl (Sodium Chloride) and 1.75 for 3% NaCl (Sodium Chloride);



standard errors were 0.047702 and 0.04267, respectively.

Median and mode values were consistent at 2 for both solutions. Standard deviations were 0.486467 for 7% NaCl (Sodium Chloride) and 0.43511 for 3% NaCl (Sodium Chloride), while sample variances were 0.23665 and 0.18932, respectively. The range for both solutions was 1, and the confidence levels at 95.0% were 0.094606 and 0.08462. Additionally, the calculated p-value was 0.58, indicating no significant difference between the two solutions based on the given parameters.

Sputum induction is a valuable technique for collecting samples in suspected Tuberculosis cases, providing results consistent with natural sputum expectoration. This method is particularly useful for patients who cannot produce adequate sputum voluntarily [5]. The use of hypertonic saline for sputum induction has shown promise in increasing the detection rate of Mycobacterium tuberculosis [MTB] [6]. Our study found that 7% NaCl nebulization yielded a higher AFB positivity rate compared to 3% NaCl nebulization, suggesting better diagnostic performance with higher saline concentrations.

Possible reason that 7% NaCl yielded a higher AFB positivity rate compared to 3% NaCl in our study are, As the hypertonic saline nebulisation concentration increase, amount of salt in Airways increases which attracts more water and thins mucus which makes it easier to cough up. Increases the volume of airway surface liquid, improves the mucus rheological properties and accelerate mucus transport rates. As the saline nebulisation concentration increases it stimulates cilia beat via the response of prostaglandin E2. Higher concentration of saline nebulisation can stimulate sensory nerves in airway increasing the airway surface liquid.

CONCLUSION

In conclusion, our study comprehensively investigated the diagnostic methodologies and demographic profiles of presumptive pulmonary tuberculosis patients, shedding light on key factors influencing Tuberculosis diagnosis. Our analysis revealed distinct patterns in diagnostic outcomes, with variations observed in

induced sputum AFB test results suggested higher positivity rate with 7% NaCl (Sodium Chloride) compared to 3 % NaCl (Sodium Chloride) induced sputum. Demographically, our study identified middle-aged and older adults, particularly males, as being at higher risk for presumptive pulmonary Tuberculosis, with specific occupational groups and individuals with previous Tuberculosis history or Tuberculosis contact also showing increased susceptibility. These findings underscore the importance of tailored diagnostic approaches and targeted interventions to optimize Tuberculosis diagnosis and treatment outcomes. Moving forward, further research is warranted to validate these findings and explore the potential impact of emerging diagnostic technologies and novel interventions on Tuberculosis control efforts, ultimately contributing to the global fight against Tuberculosis.

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