



Clinical Research

EFFECTIVENESS OF PNEUMOCOCCAL VACCINATION IN REDUCING SEVERITY OF EXACERBATIONS AND DURATION OF HOSPITAL STAY IN PATIENTS WITH BRONCHIECTASIS PRESENTING TO A TERTIARY HEALTH CENTER

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ABSTRACT

Introduction: Bronchiectasis is a chronic suppurative airway disease which progresses with recurrent exacerbations due to viral and Pneumococcal infections. One of the most effective methods of prevention of Pneumococcal infection is vaccination against it. This study is intended to assess effectiveness of Pneumococcal vaccination in reducing severity of exacerbations in bronchiectasis. **Methods:** All bronchiectasis patients who have taken Pneumococcal vaccinations were interviewed regarding number of exacerbations, number of days of hospitalization and oxygen requirement one year prior to and one year after the vaccination, and the answers were crosschecked with their case sheets to avoid recall bias and the means were compared with t-test to identify presence of any significant difference over one year. **Results:** Over the one year after Pneumococcal vaccination, number of exacerbations, number of hospital admissions, number of days in ICU, ward and the days in ventilator and the requirement for long term oxygen therapy reduced significantly in the study population. **Conclusion:** Pneumococcal vaccination significantly improves the quality of life in a bronchiectasis patient by reducing both the frequency and severity of exacerbations of the disease and also the morbidities associated with prolonged hospital stays.

KEYWORDS : Pneumococcal vaccination, bronchiectasis, hospitalization, exacerbations**INTRODUCTION**

Bronchiectasis is a chronic progressive suppurative airway disease characterized by irreversible dilatation of bronchi leading to chronic cough with massive purulent expectoration and recurrent infections leading to multiple hospitalizations. The commonest organism causing exacerbations in India after viral infections is Streptococcus pneumoniae.¹ Hence it is logical to expect that prevention of Streptococcal infections will lead to reduced number of hospitalizations, for which Pneumococcal vaccination is a pivotal step. Though a few studies in chronic obstructive airway diseases are available in this aspect, none have been conducted in bronchiectasis patients in this area.² Considering the potential benefits in the long run, patients should be educated regarding the need of timely Pneumococcal vaccination for a stable course of their chronic disease.

RESEARCH OBJECTIVES

1. Primary objective is to assess severity of exacerbations and to find out the duration of hospital stay for one year before and after Pneumococcal vaccination.
2. Secondary objective is to create an awareness among bronchiectasis patients regarding the potential benefits of timely vaccination against pneumococci.

METHODOLOGY

Study design and setting: The study was an ambi-directional observational study and was conducted in MES Medical College and Hospital.

STUDY POPULATION AND SAMPLING: All patients who were diagnosed with bronchiectasis and had taken at least one Pneumococcal vaccine 12 months before the point of contact were included in the study. Those patients with overlapping chronic airway diseases like chronic obstructive pulmonary disease (COPD), bronchial asthma, interstitial lung disease, patients who were immunocompromised (one with retroviral infections, chronic kidney disease, chronic liver disease, long term steroid treatment, malignancies including that of lung), those on long term antibiotic therapy and those not giving consent or not responding properly during the time of contact were excluded from the study. While planning the study significant sample size calculated was 57. Convenient sampling method was adopted. The total number of bronchiectasis patients interviewed were 246. Of the 246, 197 patients were vaccinated with Pneumococcal vaccination and 153 were vaccinated prior to one year. However out of this, complete cooperation and proper information could be obtained only from 108 patients which comprised the final study population.

METHOD OF STUDY: After obtaining institute ethical and scientific committee clearance all the 246 bronchiectasis patients were

contacted by one of the two investigators and those patients yet to take at least one Pneumococcal vaccine were advised regarding the potential benefits of timely vaccination. All those who have taken vaccination satisfying inclusion were included in the study as participants after obtaining their consent (Total number of study participants were 108). Direct one to one discussion with the study participants was done based on a validated study proforma, along with detailed review of their case sheets to avoid recall bias. Hospitalizations if any, 12 months prior to and 12 months after vaccination were assessed along with the total number of days in hospital (days in ventilator, ICU and ward noted separately).

The severity of exacerbations was made out by asking if the admissions were directly to ICU or ward during each time and also by assessing the need for oxygen supplementation during hospital stay and after discharge.

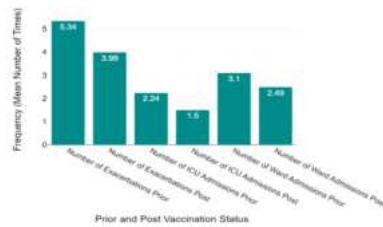
ANALYSIS:

The mean number of exacerbations one year before and one year after Pneumococcal vaccination were calculated and the same were compared using a t-test to assess significant difference between them. P value of less than 0.05 was taken as statistically significant. Using t-test, the mean number of admissions to ward as well as intensive care units one year prior and one year post pneumococcal vaccination were compared taking P value as less than 0.05 as statistically significant. Mean number of days of hospitalization and oxygen requirement one year before and after vaccination were compared in the same way to find out for a statistically significant difference. And finally mean number of days in ventilator, intensive care unit and wards were also compared to assess reduction in severity of exacerbations following Pneumococcal vaccination.

RESULTS

The year preceding vaccination, the study group experienced 5.34 ± 1.25 exacerbations on an average which was brought down to 3.99 ± 0.88 exacerbations in the year following vaccination. This difference was statistically significant with a t value was 9.178 (p value ≤ 0.01). Similarly mean number of admissions to intensive care unit (ICU) was 2.24 ± 0.77 times before vaccination and 1.5 ± 0.66 times after vaccination which was also statistically significant with a t value of 7.583 (p value ≤ 0.01). A statistically significant drop in number of admissions to ward was also noted following Pneumococcal vaccination with the mean number of ward admissions before and after the vaccinations being 3.10 ± 0.98 and 2.49 ± 0.69 respectively with a t value of 5.289. For better understanding, the above-mentioned mean frequency data is represented in the bar chart below (figure 1).

Figure 1: Bar chart depicting mean frequency of exacerbations and admissions to ICU and ward prior and post Pneumococcal vaccination



Severity of disease before and after Pneumococcal vaccination was determined by number of days of hospital stay and the oxygen requirement during one year prior to and one year post vaccination. Mean number of days in hospital one year prior to vaccination was 51.32 ± 15.96 days and the same for one year post vaccination was 34.11 ± 11.90 days. The difference was statistically significant with a t value of 8.984 (p value ≤ 0.01). There was also a statistically significant reduction in number of days the study participants were dependent on oxygen support for one year prior to and post Pneumococcal vaccination with a t value of 8.448 (p value ≤ 0.01). While the mean number of days of oxygen requirement was 60.18 ± 16.67 days in one year prior to vaccination, the same was 42.67 ± 13.64 days in the following year after vaccination. The figure 2 below is a box plot representation of the same where we can easily make out the reduction in days after vaccination.

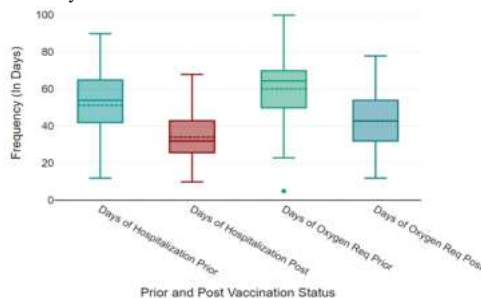


Figure 2: Box Plot depicting mean number of days of hospitalization and oxygen requirement prior and post Pneumococcal vaccination.

Mean number of days in ward, ICU and ventilator were also assessed for one year before and after Pneumococcal vaccination. In one year prior to vaccination, the mean days of stay in ward and ICU were 37.27 ± 14.15 days and 14.06 ± 5.68 days respectively and mean number of days in ventilator was 1.98 ± 3.12 days. Over the next year following vaccination, the mean days of stay in ward and ICU were 25.30 ± 9.70 days and 8.81 ± 4.36 days respectively with mean number of days in ventilator 0.25 ± 1.06 days. All the three mean values, that of ward stay, ICU stay and ventilator stay, were significantly lower (p values ≤ 0.01) after Pneumococcal vaccination with t values of 7.251, 7.620 and 5.456 respectively. The violin plot below is for better understanding of the same (figure 3).

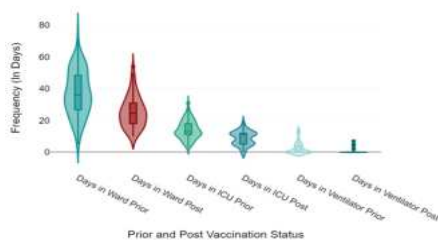


Figure 3: Violin Plot depicting mean number of days in ward, ICU and ventilator before and after vaccination.

DISCUSSION

Streptococcus pneumoniae is known to colonize nasopharynx of people and can move to lower respiratory tract and produce pneumonia in those with bronchiectasis where there is impaired mucociliary clearance of airway.³ Once infected with invasive pneumococcal disease there can be severe sepsis and prolonged hospital stay.⁴ Pneumococcal vaccination is a pivotal step in prevention of recurrent sinusitis, otitis media and community acquired pneumonia due to *Streptococcus pneumoniae* especially in those subsets of population with addictions, immunosuppression, chronic airway diseases and chronic kidney diseases.⁵ These postulations are reaffirmed with this

research project. Pneumococcal vaccination significantly reduced the number of exacerbations in study population. Number of admissions to intensive care unit and general ward were also significantly reduced in the study population following Pneumococcal vaccination.

The morbidity and financial burden associated with bronchiectasis were also significantly reduced by Pneumococcal vaccination. This was evidenced by increased days of hospital stay and increased requirement for oxygen therapy even from home in one year prior to vaccination. Each hospital stay will produce significant financial burden to the patients and that also increases the chance of getting hospital acquired infections and antibiotic resistance all of which compound to worsening of disease morbidity. Requirement for long term oxygen therapy from home may even demoralize the patients and lead them to depression. So, reduction in the days of hospitalization and of oxygen requirement has long term benefits for the patients and this study has proved beyond a reasonable doubt that Pneumococcal vaccination will significantly reduce both.

In this study pneumococcal vaccination has also brought down number of days admitted in ICU and ward significantly. Also, there is a marked reduction in the requirement of ventilator demonstrating a significant curtailment in the severity of exacerbations. This shows that even though vaccinated patients develop exacerbations, they are less frequent and severe than before. This is in line with a three year follow up study conducted in Brazil which showed sex, smoking, presence of diabetes, Chronic Obstructive Pulmonary Disease, increased emergency room visits, frequent use of oral antibiotics due to exacerbation, lack of respiratory physiotherapy, limited mobility and the absence of vaccination against pneumococci correlated with the risk of mortality in patients with bronchiectasis.⁶

CONCLUSION

Pneumococcal vaccination will significantly reduce the number of exacerbations and hospitalizations in a bronchiectasis patient. It also reduces the days of hospitalization and the requirement for long term oxygen therapy in patients with bronchiectasis. It is therefore desirable to advise timely and regular pneumococcal vaccinations for all bronchiectasis patients, as it reduces both the number and severity of hospitalizations and also the morbidities associated with the disease, thereby improving their quality of life.

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CONFLICTS OF INTEREST: Nil

REFERENCES

1. Para RA, Fomda BA, Jan RA, Shah S, Koul PA. Microbial etiology in hospitalized North Indian adults with community-acquired pneumonia. *Lung India*. 2018;35:108–15.
2. Venkitakrishnan R, Vijay A, Augustine J, et al. Hospitalisation outcomes in Pneumococcal-vaccinated versus unvaccinated patients with exacerbation of COPD: results from the HOPE COPD Study. *ERJ Open Res* 2023; 9: 00476-2022 [DOI: 10.1183/23120541.00476-2022].
3. Dockrell DH, Whyte MK, Mitchell TJ. Pneumococcal pneumonia: Mechanisms of infection and resolution. *Chest*. 2012;142:482–91.
4. Drijkoningen JJ, Rohde GG. Pneumococcal infection in adults: Burden of disease. *Clin Microbiol Infect*. 2014;20(Suppl 5):45–51.
5. Koul PA, Chaudhari S, Chokhani R, Christopher D, Dhar R, Doshi K, Ghoshal A, Luhadiya SK, Mahashur A, Mehta R, Nene A, Rahman M, Swarnakar R. Pneumococcal disease burden from an Indian perspective: Need for its prevention in pulmonology practice. *Lung India*. 2019 May-Jun;36(3):216–225. doi: 10.4103/lungindia.lungindia_497_18. PMID: 31031342; PMCID: PMC6503715.
6. Mateus SP, Ribeiro-Alves M, Salles REB, Costa W, Costa CHd, Lopes AJ, Bártholo TP, Mafort TT, Tura BR, Rufino R. Mortality and comorbidities in patients with bronchiectasis over a 3-year follow-up. *Medicine* 2022;101:52(e32537).