**Scholars Journal of Applied Medical Sciences**
Abbreviated Key Title: Sch J App Med Sci
ISSN 2347-954X (Print) | ISSN 2320-6691 (Online)
Journal homepage: https://saspublishers.com

OPEN ACCESS

**Paediatric**

# Adequacy of Bronchoalveolar Lavage in Decreasing Morbidity in Ventilated Neonates

Dr. Amber Dixit[1*], Dr. Pratibha Patil[2], Dr. Sunil Vaidya[3], Dr. Shahaji Y Gaikwad[4]

[1]Resident, Paediatric Department, Ashwini Rural Medical College Hospital and Research Centre Kumbhari Solapur, Maharashtra, India
[2]Associate Professor, Paediatric Department, Ashwini Rural Medical College Hospital and Research Centre Kumbhari Solapur, Maharashtra, India
[3]Professor and Head, Paediatric Department, Ashwini Rural Medical College Hospital and Research Centre Kumbhari Solapur, Maharashtra, India
[4]Professor, Paediatric Department, Ashwini Rural Medical College Hospital and Research Centre Kumbhari Solapur, Maharashtra, India

**DOI:** 10.36347/sjams.2022.v10i12.020 | **Received:** 07.10.2022 | **Accepted:** 20.11.2022 | **Published:** 07.12.2022

***Corresponding author:** Dr. Amber Dixit
Resident, Paediatric Department, Ashwini Rural Medical College Hospital and Research Centre Kumbhari Solapur, Maharashtra, India

**Abstract** **Original Research Article**

Early-onset pneumonia is part of generalized sepsis that first manifests at or within hours of birth. Late-onset pneumonia usually occurs after 7 days of age, most commonly in neonatal intensive care units among infants who require prolonged endotracheal intubation because of lung disease. Diagnosis is by clinical and laboratory evaluation for sepsis. Treatment is initial broad-spectrum antibiotics changed to organism-specific drugs as soon as possible. Surveillance studies of nosocomial infections in NICU patients indicate that pneumonia comprises 6.8 to 32.3% of nosocomial infections in this setting. ***Aim:*** To establish the incidence, aetiology, risk factors, and outcomes associated with pneumonia using BAL sampling technique in neonates. ***Material and methods:*** A cross sectional study carried out at neonatal intensive care unit in a tertiary health care centre in Solapur, thus 28 neonates admitted in NICU and requiring mechanical ventilation were studied for period of 2 years. Bronchoalveolar lavage samples were collected using flexible bronchoscope with two sterile mucus extractor. Isolation of >103 colony-forming unit/mL was required for diagnosis. ***Results:*** 79% of neonates had culture positive growth and 21% had culture negative growth Most common pathogen isolated was E coli 25%. The organisms isolated were found to have different sensitivity pattern on the culture report and the patients were treated accordingly. Enlisted here are few of the antibiotics which were found to be sensitive. ***Conclusion:*** It's unique and very effective way to isolate the organism causing respiratory pathology and provide antimicrobial therapy according to susceptibility pattern rather than giving broad spectrum antibiotics for a longer duration and time and increasing incidence for drug resistance.

**Keywords:** pneumonia, sepsis, bronchoalveolar lavage, neonate.



## INTRODUCTION

The greatest risk of death from pneumonia in childhood is in the neonatal period. It is estimated that pneumonia contributes to between 750,000-1.2 million neonatal deaths annually, accounting for 10% of global child mortality [1].

Early-onset pneumonia is part of generalized sepsis that first manifests at or within hours of birth. Late-onset pneumonia usually occurs after 7 days of age, most commonly in neonatal intensive care units among infants who require prolonged endotracheal intubation because of lung disease [2].

Diagnosis is by clinical and laboratory evaluation for sepsis. Treatment is initial broad-spectrum antibiotics changed to organism-specific drugs as soon as possible.

Surveillance studies of nosocomial infections in NICU patients indicate that pneumonia comprises 6.8 to 32.3% of nosocomial infections in this setting [3].

National Nosocomial Infection Surveillance (NNIS) data from 2002 to 2004 show pneumonia rates ranging from 1.4 to 3.5 per 1,000 ventilator days [3].

In another cross sectional survey it was concluded that incidence of Ventilator associated pneumonia is highest amongst neonates weighing < 1500 grams [3].

Imaging Test Evidence for pneumonia two or more serial chest imaging test results with at least one of the following [4]:-

- New and persistent or Progressive and persistent Infiltrate.
- Consolidation.
- Cavitation.
- Pneumatoceles.

**Signs and Symptoms**

For infants≤ 1 year old [4]:

Worsening gas exchange (for example: O2 desaturations [for example pulse oximetry < 94%], increased oxygen requirements, or increased ventilator demand) and at least three of the following:

- Temperature instability.
- Leukopenia (≤ 4000 WBC/mm3) or leukocytosis (≥ 15,000 WBC/mm3) and left shift (≥ 10% band forms).
- Increased respiratory secretions, or increased suctioning requirements.
- Apnea, tachypnea, nasal flaring with retraction of chest wall, or nasal flaring with grunting.
- Wheezing, rales, or rhonchi.
- Cough.
- Bradycardia (< 100 beats/min) or tachycardia (> 170 beats/min).

**Aetiology**

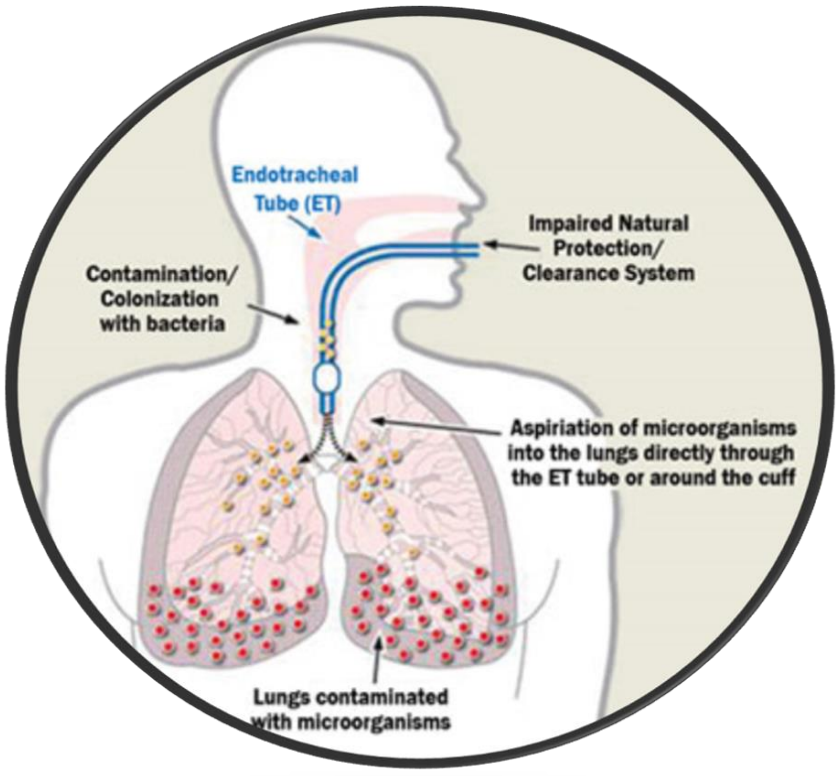
The etiology of pneumonia in the neonate varies widely because of several modes of acquisition of infecting agents. Neonates may develop pneumonia in utero as a part of a congenital infection; however, more often, infants are exposed to potential pathogens in the perinatal and postnatal periods[2]. These organisms include gram-positive cocci (eg, groups A and B streptococci, both methicillin-sensitive and methicillin-resistant Staphylococcus aureus) and gram- negative bacilli (eg, Escherichia coli, Klebsiella species and Proteus species) [2]. Other pathogens may be found, including Pseudomonas, Citrobacter, Bacillus, and Serratia [2].

**Pathogenesis**

Aspiration of colonized microorganisms in the oropharynx and the Gastrointestinal tract is one mechanism of developing pneumonia in chronically ventilated neonates [5].

Aspiration of contaminated secretions into the lower airway [5].

Endotracheal increases intubation risk of developing pneumonia by 6-21 fold and accounts for 90% infections in mechanically ventilated patients [5].



**Aim**

To establish the incidence, aetiology, risk factors, and outcomes associated with pneumonia using BAL sampling technique in neonates.

## OBJECTIVE

- To aid in the early identification, in neonates who are at high risk of developing resistant Pneumonia and treat them to have complete control.
- Decrease morbidity by providing organism specific antimicrobial therapy and thus reducing the hospital stay and morbidity.

## METHODOLOGY

A cross sectional study carried out at neonatal intensive care unit in a tertiary health care centre in Solapur, thus 28 neonates admitted in NICU and requiring mechanical ventilation were studied for period of2 years.

**Inclusion Criteria**

- Neonates having symptoms of severe pneumonia.
- Gestational age >24weeks.
- Neonates showing signs of pneumonia radiologically & clinically.
- Parent/guardian who are willing to give consent for the study.

**Exclusion Criteria**

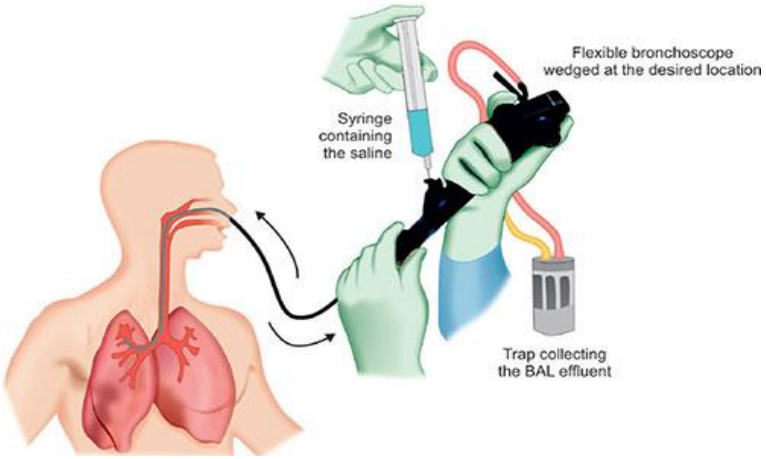
- Age > 30 days.
- Congenital anomalies and bleeding tendency/coagulopathy.
- Congenital cyanotic or acyanotic heart disease.
- Inborn errors of metabolism.
- Parent/guardians not willing to give consent for the study.

Ethical clearance was obtained for the study by the ethical committee of the tertiary health care centre in Solapur. Children fulfilling the selection criteria were selected and parents were briefed about the nature of the study and consent was obtained. Demographic details, antenatal and birth history along with examination were duly noted and the cases hence classified as early onset or late onset pneumonia.

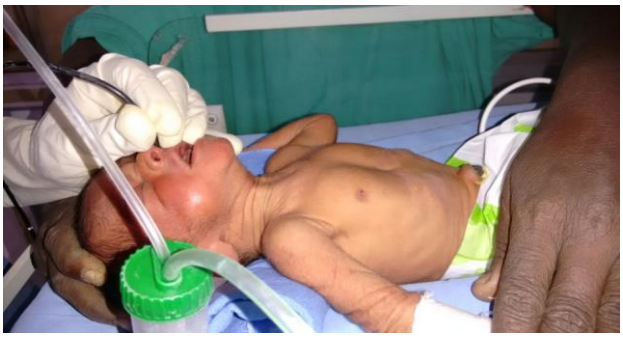
**Procedure**

- A fibre optic bronchoscope (Pentax 2.8mm).
- Drugs (Adrenaline, Atropine), Xylocaine spray.
- Sterile collection traps for collecting specimens.
- A sterile saline source.
- A suction device and tubing.

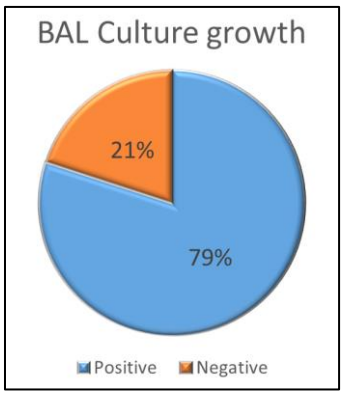
With the patient under anaesthesia/sedation bronchoscope is lowered in the respiratory tract in the tracheobronchial tree wedged into the place and saline applied samples can be obtained by suction or sterile syringes and Sent for antibiotic sensitivity.

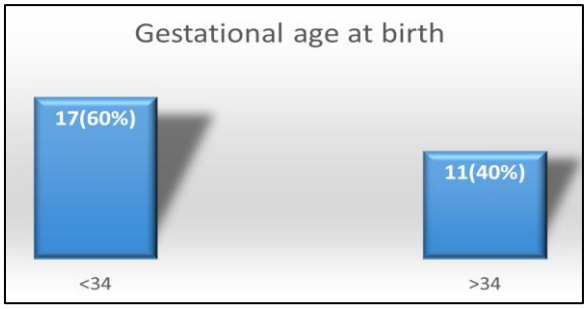

Bronchoalveolar lavage samples were collected using flexible bronchoscope with two sterile mucus extractors. Isolation of >103 colony-forming unit/mL was required for diagnosis.



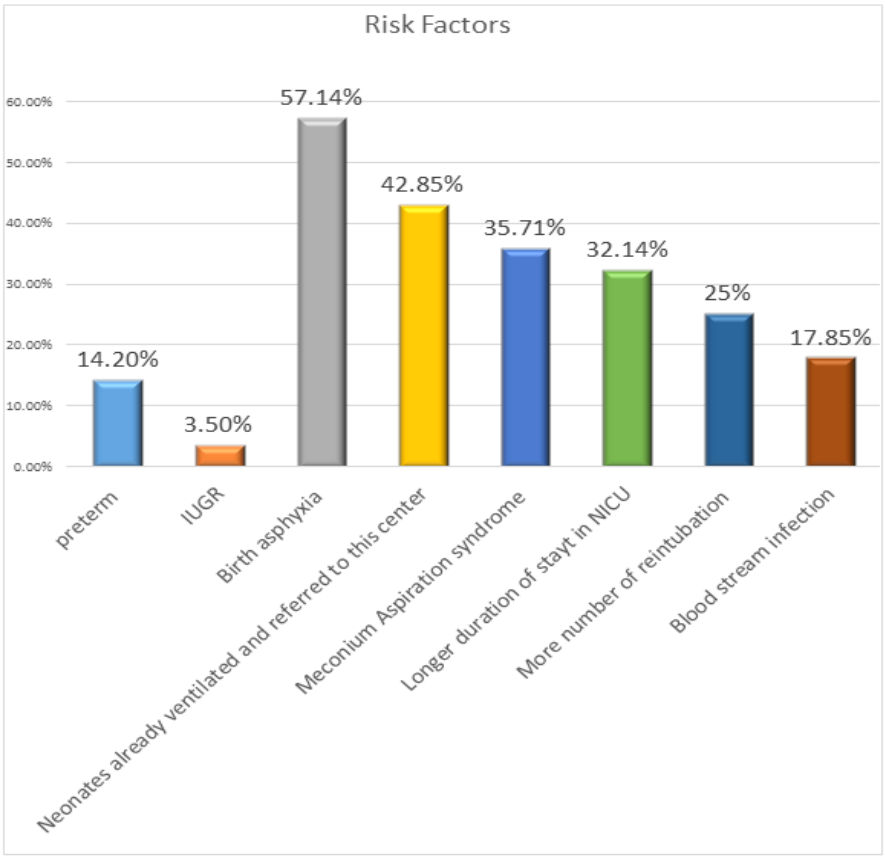
## RESULTS



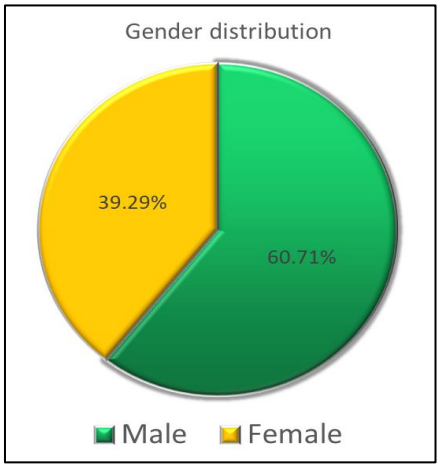

79% of neonates had culture positive growth and 21% had culture negative growth.




Majority of the neonates involved in the study were <34 weeks.




Most common risk factor was birth asphyxia 57.14%.

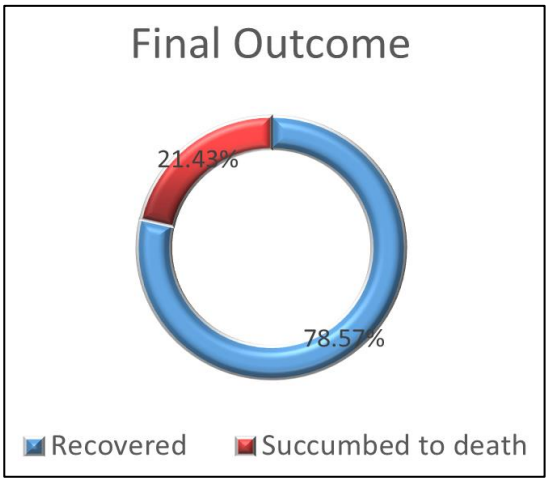



Majority were males 60.71%.

| **Pathogens isolated** | **Total *n*=28(100%)** |
|---|---|
| Escherichia Coli | 7(25%) |
| Klebsiella Pneumoniae | 5(17.9%) |
| Pseudomonas Aeruginosa | 3(11%) |
| Acinetobacter Baumannii complex | 3(11%) |
| Enterococcus | 2(7.1%) |
| MRSA | 1(3.5%) |
| Stenotrophomonas Maltophilia | 1(3.5%) |
| Sterile | 6(21%) |

Most common pathogen isolated was E coli 25%. The organisms isolated were found to have different sensitivity pattern on the culture report and the patients were treated accordingly. Enlisted here are few of the antibiotics which were found to be sensitive.

| **Antimicrobials used according to culture sensitivity report** |
|---|
| Amikacin |
| Meropenem |
| Colistin |
| Linezolid |
| Vancomycin |




## DISCUSSION

Study by Chih M T *et al.,* [6] showed similar results. Males were affected more and duration was 15.5 days. Most frequently isolated agents were Streptococcus viridians (10 of 38 positive cultures, 26.3%), Pseudomonas aeruginosa (9/38, 23.7%), and Staphylococcus aureus whereas in our study E. coli (25%) was the most common organism isolated followed by Klebsiella pneumoniae (17.9%) and pseudomonas aeruginosa (11%).

Fujitani S *et al.,* [7] studied compared the semi quantitative (endotracheal aspirates) & quantitative BAL methods for culture and sensitivity of pathogens and it was found out that the former had high false positivity rates than the latter proving efficacy and accuracy of BAL as an essential diagnostic tool, which is corroborative of our study as well. C T Minshall *et al.,* [8] concluded that positive screening-BAL results in ICU patients are associated with the development of ventilator-associated pneumonia by the same organism and may play a role in identifying patients at risk for pneumonia. Further studies must be conducted to evaluate the role of screening-BAL in this patient population. Thatrimontrichai *et al.,* [9] isolated neonatal birth weight of less than 750 grams and use of sedation in mechanically ventilated infants as independent risk factors for prolonged ventilation and development of pneumonia, similar to our studies where VLBW infants and number of intubations were amongst the important risk factors although birth asphyxia (57.14%) was isolated to be most frequently associated independent risk factor. Arafa M A *et al.,* [10] conducted a similar study where the most commonly isolated pathogens were gran negative bacteria particularly Klebsiella Pneumoniae, similar to our study.

## STRENGTHS & LIMITATIONS

It's unique and very effective way to isolate the organism causing respiratory pathology and provide antimicrobial therapy according to susceptibility pattern rather than giving broad spectrum antibiotics for a longer duration and time and increasing incidence for drug resistance.

Limitations include it's invasiveness in nature and need for skilled professional and a well-equipped intensive care.

## REFERENCES

1. Nissen, M. D. (2007). Congenital and neonatal pneumonia. *Paediatric Respir Rev*, 8(3), 195-203. doi: 10.1016/j.prrv.2007.07.001. Epub 2007 Sep 6. PMID: 17868917.
2. By Brenda, L., & Tesini, M. D. (2022). University of Rochester School of Medicine and Dentistry Last full review/revision Jul 2022| Content last modified Sep 2022.
3. National Nosocomial Infections Surveillance System. (2004). National Nosocomial Infections Surveillance (NNIS) System report, data summary

from January 1992 through June 2004, issued October 2004.
4. Magill, S. S., Klompas, M., & Balk, R. (2013). Developing a new, national approach to surveillance for ventilator associated events. *Crit Care Med*, 41(11), 2467-2475.
5. Antoni Torres & School of Medicine, University of Barcelona, Barcelona, Spain c Department of Pneumology, Thorax Institute, Hospital Clinic of Barcelona, Spain.
6. Liao, C. C., Tsai, M. H., Lai, S. H., Lai, M. Y., Chu, S. M., Huang, H. R., ... & Hsu, J. F. (2021). Safety and clinical application of nonbronchoscopic bronchoalveolar lavage in preterm neonates with clinical ventilator-associated pneumonia. *Pediatrics & Neonatology*, *62*(2), 195-201.
7. Fujitani, S., Cohen-Melamed, M. H., Tuttle, R. P., Delgado, E., Taira, Y., & Darby, J. M. (2009). Comparison of semi-quantitative endotracheal aspirates to quantitative non-bronchoscopic bronchoalveolar lavage in diagnosing ventilator-associated pneumonia. *Respiratory Care*, *54*(11), 1453-1461.
8. Minshall, C. T., Eriksson, E. A., Hawkins, K. S., Wolf, S., & Minei, J. P. (2013). Early nonbronchoscopic bronchoalveolar lavage: predictor of ventilator-associated pneumonia?. *Journal of Trauma and Acute Care Surgery*, *74*(2), 448-453.
9. Thatrimontrichai, A., Rujeerapaiboon, N., Janjindamai, W., Dissaneevate, S., Maneenil, G., Kritsaneepaiboon, S., & Tanaanantarak, P. (2017). Outcomes and risk factors of ventilator-associated pneumonia in neonates. *World journal of pediatrics*, *13*(4), 328-334.
10. Azab, S. F., Sherbiny, H. S., Saleh, S. H., Elsaeed, W. F., Elshafiey, M. M., Siam, A. G., ... & Gheith, T. (2015). Reducing ventilator-associated pneumonia in neonatal intensive care unit using "VAP prevention Bundle": a cohort study. *BMC infectious diseases*, *15*(1), 1-7.