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Incidence of neonatal pneumothorax in rural tertiary care hospital in preHFOV era

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ABSTRACT

ORIGINAL RESEARCH ARTICLE

Pneumothorax is a critical condition characterized by the presence of air in the pleural space, which can lead to significant morbidity in neonates. This descriptive longitude+,inal observational study was conducted to assess the incidence of neonatal pneumothorax in a rural tertiary care hospital during the pre-High-Frequency Oscillation Ventilation (HFOV) era. The study involved all neonates admitted to inborn and outborn Neonatal Intensive Care Units (NICUs) from December 2020 to December 2022 at Dr. Balasaheb Vikhe Patil Rural Medical College, Loni. A total of 27,954 inborn neonates were delivered during the study period, of which 38 developed pneumothoraxes, resulting in a prevalence of 0.2%. Among the total admitted NICU patients (7,395), 60 neonates developed pneumothorax, corresponding to a prevalence of 0.8%. Risk factors such as respiratory distress syndrome (RDS), mechanical ventilation, and meconium aspiration syndrome were evaluated. The study found that early detection via bedside transillumination tests followed by chest X-rays facilitated timely diagnosis. Treatment options varied from observation for small pneumothoraxes to CPAP, needle aspiration, and chest tube insertion for more severe cases. The study's findings align with other research in the field but note lower incidence rates due to the limited study duration compared to others. The study concludes that neonatal pneumothorax remains a significant concern, with a call for future research involving larger sample sizes and advanced ventilation modalities such as HFOV to reduce the incidence and improve outcomes in rural settings. Limitations included the exclusive use of conventional mechanical ventilation during the study.

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INTRODUCTION-

Pneumothorax implies the presence of air in the pleural space between the visceral and parietal pleura.[1] With the first inspiratory breath, the newborn creates a transpulmonary pressure greater than 100 cm of water column

and opens the lungs that were closed in-utero. After a couple of breaths, this pressure normalizes and the lungs take over their function. If the transpulmonary pressure remains elevated for a long time, the alveoli rupture occurs, accumulating air between the visceral and parietal pleura. The air created in the interpleural space leads to a pathological condition called neonatal pneumothorax (NP). Pneumothorax developed in this way is called spontaneous (primary, idiopathic).[2] The reason for the development of secondary pneumothorax in newborns may be respiratory distress syndrome (RDS), mechanical ventilation (MV), pneumonia, sepsis, aspiration of meconium, blood and amniotic fluid, or congenital lung malformations. [3] The consequences of primary and secondary pneumothorax are high pressure within the pleural space followed by lung collapse on the affected side, immediate hypoxia, hypercapnia and subsequent circulation collapse.[4]

The incidence of pneumothorax in neonates is highly variable depending on several factors. Among many risk factors, prematurity and mechanical ventilation are considered the most important. Risk factors for neonatal PT also include respiratory distress syndrome, meconium aspiration syndrome, congenital malformations, infections, transient tachypnoea of the newborn, immaturity, and specific respiratory procedures such as mechanical ventilation, intubation, endotracheal suctioning, and fraction of inspired oxygen> 0.4. [7]

The incidence of pneumothorax in preterm infants who are supported with mechanical ventilation varies from as high as 33% [7] to as low as 6%.[8,9] The risk also increases with the presence of meconium aspiration, hyaline membrane disease, pneumonia, and pulmonary hypoplasia. [7-11] Use of positive pressure ventilation during resuscitation also increases the risk of pneumothorax in the newborn. [12] Nasal continuous positive airway pressure (CPAP) at birth has recently been considered as a treatment modality in preterm infants. Multiple reports have indicated that the use of early CPAP is associated with decreased intubation, fewer oxygen days and lower rates of bronchopulmonary dysplasia (BPD). [13,14] The relationship between the early use of CPAP and pneumothorax has not been settled.

Hence, we planned this descriptive observational study with the objective to assess the incidence of pneumothorax in neonates in rural tertiary care hospital in pre HFOV era.

Aim

To study incidence of neonatal pneumothorax in rural tertiary care hospital in preHFOV era

Objective:

1. To study incidence of pneumothorax in inborn cases.
2. To study the incidence of pneumothorax in total admitted cases.

MATERIALS AND METHOD

Our study is a descriptive longitudinal observational study with all the neonates who developed pneumothorax in inborn and outborn NICU. It was conducted from 2 years from December 2020- December 2022 at Dr Babasaheb Vikhe Patil Rular Medical College, LONI after obtaining approval from the ethical committee.

Due written and informed consent was taken from the parents of neonates before including them in the study.

Inclusion Criteria

1. All neonates with pneumothorax
2. Babies whose parents are giving informed written consent for inclusion in study

Exclusion Criteria

1. Babies having major congenital malformations.

Data Collection:

All neonates with pneumothorax in inborn and outborn NICU meeting the inclusion criteria had included in the study.

Sample size

60 new born babies in Pravara hospital medical college having sign and symptoms of pneumothorax

METHODS

Method of collection of data

The data was obtained from neonates that were delivered in our hospital which were admitted in inborn NICU and referred from another hospital which were admitted in outborn NICU and met the inclusion and exclusion criteria. As soon as we noticed any neonate who had sudden increased in distress, fluctuation in saturation or unexplained event of cyanosis, we had screen that neonate for pneumothorax.

Initially we had done bedside screening tans-illumination test and if transillumination test is positive we did chest x-ray to diagnosed pneumothorax. As soon as we diagnosed the case of pneumothorax, we retrospectively had taken details history like maternal history of PV leak, significant ANC scan, antenatal received steroids dose, any major illness, details about delivery like type of delivery, gestational age, mode of resuscitation of, APGAR score, use of AMBU bag required for resuscitation and need for use of oxygen in labor room itself and all the similar history we record from the baby that had referred to us.

We recorded all the details if the neonate had RDS and required surfactant, if they had congenital pneumonia, MAS, history of birth asphyxia. Then we had recorded the vitals- Heart rate, respiratory rate, oxygen saturation level, capillary refill time and cyanosis.

If baby presented with small pneumothorax like pockets and with no distress then we had done observation to check spontaneous resolution of pneumothorax. If it had not resolved or increased in size causing respiratory distress then we had taken baby on CPAP followed by needle aspiration of that pneumothorax. Needle aspiration was done by 23G or 25G butterfly needle in second intercostal space in midclavicular line.

Some neonate presented with respiratory distress, cyanosis and pneumothorax who required ventilator support, so in those cases we had done chest tube insertion by French size 10 or 12 in 4th intercostal space and sutured with 3-0 silk with underwater drainage system. Chest x-ray was done to confirm the position of tube. As baby was on ventilator, we had done ABG to check its metabolic status.

After the neonate lung disease improved and chest tube not drained air for 24-48 hours and if radiographic examination shows no reaccumulation of air in next 12-24 hours, we had removed the chest tube.

After collecting the data, we had analyzed the incidence and result are as follows.

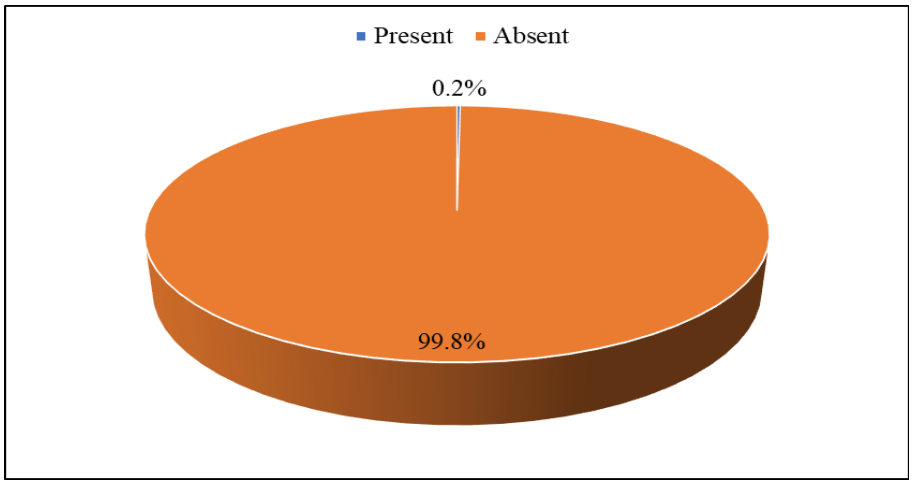
RESULTS

These are the results done on descriptive longitudinal study involving all neonates inborn and outborn who developed pneumothorax during hospital stay during period of December 2020 to December 2022.

Table 1: Prevalence of pneumothorax amongst inborn cases

		Frequency	**Percent**
Pneumothorax	Present	38	0.2
	Absent	27894	99.8
	Total	27954	100.0

During study period, Total 27954 babies delivered in our hospital, Out of which 38 babies developed pneumothorax. Hence the prevalence of pneumothorax in inborn cases was 0.2%.

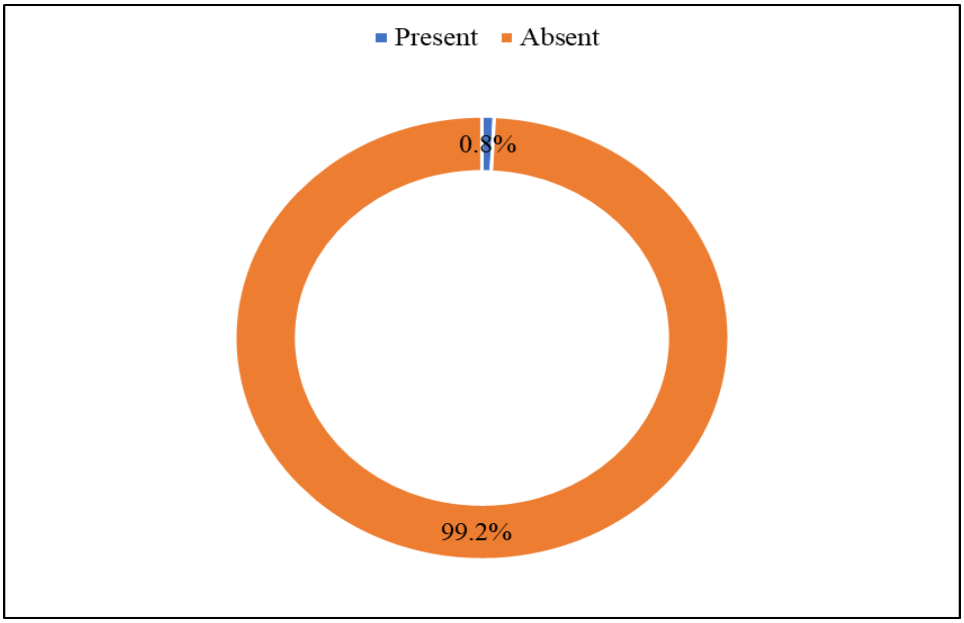


Graph 1: Pie diagram showing Prevalence of pneumothorax amongst inborn cases

Table 2: Prevalence of pneumothorax amongst total admitted (inborn and outborn) cases

		Frequency	Percent
Pneumothorax	Present	60	0.8
	Absent	7335	99.2
	Total	7395	100.0

During study period, Total 7395 patients were admitted in inborn and out born NICU, Out of which 60 developed pneumothoraxes. Hence the prevalence of pneumothorax in total admitted cases was 0.8% in study.



Graph 2: Pie diagram showing Prevalence of pneumothorax amongst total admitted (inborn and outborn) cases

DISCUSSION

This is descriptive longitudinal study involving all neonates inborn and outborn who developed pneumothorax during hospital stay during period of December 2020 to December 2022.

Table 3: Incidence of pneumothorax amongst inborn cases

Study	Incidence of pneumothorax in admitted cases
Present study	0.2%
Jovandaric M Z et al[27]	1.89%

- During study period, Total 27954 babies delivered in our hospital, Out of which 38 babies developed pneumothorax. Hence the incidence of pneumothorax in inborn cases was 0.2%.
- Jovandaric M Z et al[27] has higher incidence of pneumothorax cases in admitted cases as they have more duration of study period almost 12 years.

Table 4: Incidence of pneumothorax amongst total admitted cases (inborn plus outborn)

Study	Incidence of pneumothorax cases
Present study	0.8%
Silva IS et al[23]	1.5%
Lim HS et al[21]	1.3%
Avadhesh Joshi et al[25]	1.3%
Jovandaric M Z et al[27]	2.40%

- During study period, Total 7395 patients were admitted in inborn and out born NICU, Out of which 60 developed pneumothorax. Hence the incidence of pneumothorax in total admitted cases (inborn and outborn) was 0.8% in study which is comparable with Lim HS et al[21], Silva IS et al[23] and Avadhesh Joshi et al[25].
- Jovandaric M Z et al[27] had higher incidence (2.40%) in admitted cases as their study period was 12 years.

CONCLUSION:

- Neonatal pneumothorax remains a significant concern in NICUs, albeit with a relatively low incidence in the studied rural tertiary care setting. The findings underscore the need for vigilant monitoring of neonates at risk of pneumothorax, especially those undergoing mechanical ventilation or with underlying respiratory conditions.
- High frequency oscillation ventilation (HFOV) is an advanced mode of mechanical ventilation which is used in the treatment of neonatal pneumothorax. HFOV helps in the stabilization of air leaks by reducing pressure fluctuation. Further research with larger sample sizes and longer study periods with the use of HFOV is recommended to better understand incidence of neonatal pneumothorax in rural tertiary care hospital settings.

Limitation:

This study had completed with the use of only conventional mechanical ventilator.

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