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NEONATAL PNEUMONIA: INCIDENCE, AETIOLOGICAL PROFILE AND CORRELATION BETWEEN RADIOLOGICAL AND HAEMATOLOGICAL FINDINGS IN ITS COURSE

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ABSTRACT

BACKGROUND: Respiratory distress is a common condition affecting up to 7% of all term newborn and is increasingly common even in modest prematurity (13). Therapeutic and more importantly preventive measures for some of the most common underlying causes are well studied and when implemented can reduce mortality and morbidity to a great extent (1). Respiratory distress is one of the most common causes for which a newborn is admitted in neonatal intensive care unit. 15% of term neonate and 29% of late preterm neonates admitted to the neonatal intensive care unit develop significant respiratory morbidity(2). The common causes of respiratory distress like TTN, RDS, neonatal pneumonia, MAS, PPHN etc are results of complications during prenatal and postnatal transition period(3). To approach a case with respiratory distress, detail history and examination must be done. Time and mode of onset of the symptoms should be confirmed and severity of the distress should be assessed by Downe's and Silverman score. Among the above causes pneumonia is a common cause of mortality and morbidity in newborn. To diagnose a case of neonatal pneumonia chest radiograph and sepsis work up to be done. After initiation of treatment the newborn may improve or further deteriorate. The progress of the disease can be assessed by examining X-Ray in the course of the disease (5). Some studies show serial CRP has a role in determining the duration of antibiotic therapy but there is little knowledge about how the radiological and haematological parameters are interrelated(6,19). Hence, the present research study intends to study the aetiological profile and correlation between radiological and hematological findings in neonatal pneumonia in a tertiary care hospital.

AIMS AND OBJECTIVES

- To find out the incidence and etiological agent of pneumonia in neonates in our study setting.
- To study the hematological parameters on the day of diagnosis and on day 3 of antibiotic therapy and day 7 of antibiotic therapy.
- To study the chest X-Ray of the neonate on the day of diagnosis and on day 3 and day 7 of antibiotic therapy and correlate them with hematological parameters.

METHODOLOGY

The study was conducted at SNCU and NICU of Department of Pediatric Medicine, Medical College and Hospital, Kolkata from May 2019 to April 2020. All newborn with respiratory distress who is diagnosed with pneumonia on the basis of radiological finding. i.e. nodular or coarse patchy infiltrate, diffuse haziness or granularity, air bronchogram, lobar or segmental consolidation(7) will be included in the study if satisfying the selection criteria after taking informed consent from the parents. Detailed history with utmost care should be taken to evaluate antenatal, natal and post natal history. Blood samples of babies will be drawn and CBC, sepsis screen and blood culture would be done. Along with these some base line investigation would be carried out like urea, creatinine, sodium, potassium, liver function test etc. These values will help in monitoring of the patient during the study period. Proper treatment should be started for the baby with antibiotics, hemodynamic and respiratory support. After 3 days of antibiotic and supportive therapy the baby will be assessed again whether the symptoms and the general condition improved or not and chest X-Ray will be taken along with blood samples will be drawn. Analysis of the X-Ray and blood samples to be done. On day 7 of antibiotic therapy the same procedure will be done again. The results will be plotted on table and statistical analysis will be done accordingly.

RESULTS

Incidence of pneumonia is 22% of the hospitalised neonates in the study setting. The established etiology of pneumonia is mainly bacteriological Klebsiella sp (34%), E. Coli (22%),Staph aureus (20%),Streptococcus sp (16%), Candid (3.4%).On studying the haematological parameter,there is no major difference in haemoglobin value in the day 3 of admission.The mean TLC and Absolute neutrophil count is increased on day 3 and later decreased on day 7.There is gradual decrease of mean lymphocyte count over the 3 days of investigation.There is no significant change in mean platelet count and mESR over the 3 days of investigation.There is gradual decrease of mean CRP level over the course of the treatment. The radiological feature which is most commonly found is alveolar infiltrates we found in 35 % cases the severity of chest X-ray is increased on day 3 in respect to day 1. Their mean TLC is decreased on day 3 in comparison to day 1. Their mean platelet count is decreased on day 3. But there is no significant change in mean CRP value on day 3 with respect to day 1.In 28% cases the chest X-ray severity is increased on day 7 in respect to day 3 finding. Here also the mean TLC and mean platelet count decreases on day 7 in comparison to day 3. There is no significant change in mean CRP level in respect to day 3.

CONCLUSION

According to results of this study the prognosis of neonates with pneumonia can be assessed by serial TLC, platelet count and CRP evaluation. The need for repeated X-ray radiation can be minimised.

KEYWORDS : Neonatal pneumonia, chest x-ray, Total leucocyte count(TLC), CRP.

INTRODUCTION

Neonatal pneumonia is a major cause of mortality worldwide. Pneumonia is among the most common respiratory disorders in neonates. Its prevalence is more in developing countries. In developing countries, pneumonias account for more than 50% cases of respiratory distress in the newborn(7). Pneumonia is the invasion of lung by an infectious agent which may start an inflammatory response and ensuring damage involving airways, alveoli, connective tissue, visceral pleura and vascular structure and there may be fever, respiratory symptoms and evidence of parenchymal involvement diagnosed either by physical examination or by presence of infiltrates on chest radiograph(4). Respiratory infection in newborn may be bacterial, viral, fungal, protozoan or spirochetal in origin. Babies may acquire pneumonia transplacentally through infected amniotic fluid and this perinatal pneumonia is the most common form of pneumonia in neonates.

According to a study done by Dr. T Duke on 2005 it is estimated that 3.9 million of the 10.8 million deaths in children annually worldwide occur in the first 28 days of life and pneumonia accounts for a substantial proportion of this. It is estimated that pneumonia contributes to between 75000 to 1.2 million neonatal deaths and an unknown number of stillbirths as reported by child health research project on 1999(8). The etiology depends on time of onset, Gram negative bacilli predominate in the first week of life and gram positive bacteria after that (9). Streptococcus pneimoniae probably causes maximum number of neonatal pneumonia worldwide(10).

Neonates with life threatening non infective respiratory and cardiac problems (hyaline membrane disease, Congestive heart failure) may develop superadded bacterial infection leading to pneumonia. Infants requiring endotracheal intubation and assisted ventilation are also at risk to develop secondary pneumonia. However among all the

predisposing factors, aspiration is most common initiating pathogenic mechanism(11). Klebsiella, E. Coli, Enterobacter, Pseudomonus aeruginosa, Staphylococcus aureus, and albus are common etiologic agents. Chlamydial infection may produce interstitial pneumonia during 2 to 8 weeks of age. Primary pneumonias are more common among term or post-term infants because of higher incidence of prenatal aspiration because of foetal hypoxia as a result of placental dysfunction(12). Preterm babies may develop pneumonia postnatally as a consequence of septicaemia, aspiration of feeds and assisted ventilation for respiratory failure due to any cause.

The infant with congenital pneumonia is born following predisposing factors and is often asphyxiated and sick at birth(13). Respiratory distress is noticed soon after birth or during 1st 24 hours of life. Auscultatory findings are non specific and localized or generalized rales may be audible. The newborn baby may die from pneumonia without manifesting any respiratory distress. In all infants with prolonged rupture of membranes or respiratory distress soon after birth, gastric aspirate should be collected in a heparinised tube and examined for cytology. A drop of uncentrifuged stomach aspirate is placed on a clean glass slide and a thick smear is made with the help of another glass slide. After staining with Leishman's stain, total number of polymorphonuclear leukocytes (lobed nuclei) and epithelial cells are counted in five high power fields and mean number of cells per one high power field is calculated. The presence of more than 5 polymorphonuclear leukocytes per high power field or when their number exceeds three times the epithelial cell count, it is suggestive of intrauterine congenital pneumonia. Sepsis screen may be positive. Bacterial cultures should be sought from liquor amnii, gastric aspirate, throat, external year, umbilical stump and blood of the baby. In infants with congenital pneumonia, there is a good correlation between the pathogens isolated from throat swab and genital tract.

Chest X-Ray must be taken in all sick infants even when there are no symptoms or signs referable to the respiratory system. It may show bilateral opacities or evidences of atelectasis and consolidation. In a case of pneumonia, serial skiagrams would show worsening during next 24 to 48 hours while prompt resolution of bilateral opacities would favour massive meconium aspiration. Pneumonitis in right upper zone is suggestive of postnatal aspiration and tracheoesophageal fistula must be ruled out. Skiagram may show underlying congenital malformation or development of life threatening complications like pneumothorax. Blood gases and acid base parameters must be monitored to assess the severity of respiratory failure and response to therapy.

The baby is often born following predisposing factors including prolonged rupture of membranes, peripartal febrile maternal illness and prematurity(14). Respiratory distress invariably occurs within 3 hours and is complicated by apneic attacks and shock early during the course of illness. The disease runs a rather fulminant course with poor outcome. X-Ray chest appearances are similar to hyaline membrane disease unless additional distinctive features of bilateral coarse lower lobe opacities and increased interstitial markings are present(15). Pathologically atypical patchy hyaline membranes are seen infiltrated with inflammatory polymorphs and streptococci. Atelectasis is minimal. Diagnosis is supported by the presence of polymorphs in gasric aspirate and confirmed by demonstration of streptococci in the amniotic fluid, gastric aspirate, blood or lung aspirate.

The prognosis is related to the maturity of the infant and severity or nature of underlying condition and offending organisms(16). Infants with aspiration of clear fluids do better than those with meconium aspiration syndrome. Early onset Group B streptococcal infection runs a fulminant course with fatal outcome(17). Infants with septicaemia and systemic manifestations do poorly as compared to those with isolated pneumonia. The mortality varies between 20-25%.

AIMS AND OBJECTIVES

Research Hypothesis/ Study Question-

Is there any relationship between X-Ray finding and hematological finding in the disease course of pneumonia in neonates?

Specific Objectives:

1. To study the incidence of pneumonia in hospitalized neonates in SNCU of our institute in relation to period of gestation, birth weight, any predisposing factor etc.
2. To find out the etiological agent of pneumonia in neonates in our study setting.
3. To study the hematological parameters on the day of diagnosis and on day 3 of antibiotic therapy and day 7 of antibiotic therapy.
4. To study the chest X-Ray of the neonate on the day of diagnosis and on day 3 and day 7 of antibiotic therapy and correlate them with hematological parameters.

MATERIALS AND METHODS

Study design- Observational prospective single centre study.

Study setting-

1. Clinical setting taking the sick newborns in consideration, Neonates admitted in the SNCU (sick newborn care unit) complex of this institute are enrolled in the study.
2. Radiological setting for X-Ray.
3. Laboratory setting for investigations like blood count, culture etc.

Place Of Study- SNCU and NICU of Department of Pediatric Medicine, Medical College and Hospital, Kolkata.

Study Period- may 2019 to April 2020

Study Population- All newborn with respiratory distress who is diagnosed with pneumonia on the basis of radiological finding. i.e. nodular or coarse patchy infiltrate, diffuse haziness or granularity, air bronchogram, lobar or segmental consolidation.[26]

Sample Size-

There are approximately 7000 to 8000 admissions in each year in our SNCU. So I am taking the population as 8000. From the records and other studies it is found that frequency of pneumonia in hospitalised neonates are about 16% to 20%. I am taking a mean of 17%. If we take confidence level as 95% and acceptable error 5%, by calculation the sample size is estimated as 212. So I can take sample size of approximately 250.

Sample Design-

The sample in our study will be selected by the following criteria-

1. Diagnosed case of pneumonia according to chest X-Ray finding.
2. Their parents are consenting to the examination investigation and treatment protocol.

Exclusion Criteria-

Patients are excluded if-

1. Neonates with congenital anomalies, more importantly congenital heart disease or lung anomalies.
2. Neonates with RDS.
3. Neonates with meconium aspiration syndrome.
4. Neonates who are put on mechanical ventilation. Because the course may be altered due to ventilator associated pneumonia.
5. Neonates who have acute complication of pneumonia e.g. pneumothorax, empyema, pneumatocele etc.
6. Parents not consenting for the study.

Parameters To Be Studied-

1. Detailed history of the patient regarding period of gestation, any predisposing factors etc.
2. Examination of the neonate; respiratory system in detail.
3. Radiological examination i.e. chest X-Ray
4. haematological findings like haemoglobin,total count,differential count, platelet,CRP,mESR,blood culture and sensitivity, sodium, potassium, calcium and coagulation profile.
5. After starting of antibiotic, follow up on day 3 and day 7 of the disease course.

Statistical Analysis Plan-

Standardized forms (case record form) are to be used to record the relevant demographic, historical, clinical, laboratory data for each child before uploading to a data base maintained to track the clinicopathological progress of the babies. Records kept will be confidential and available only to staff related to day to day care of the babies. MS Excel and SPSS will be used where appropriate for analysis. My study variables will be the following

1. Total admission in SNCU
2. Total number of cases of pneumonia in admitted neonates
3. Blood culture report of the cases.
4. Chest X-Ray finding of the case on day 1, day 3 and day 7.
   Some haematological findings on day 1, day 3 and day 7 like
5. Total WBC count

6. Total neutrophil count
7. Platelet count
8. CRP level

These variables will be plotted on table and analysis will be done in the form of multiple regression model. The correlation among the variables will be determined on the basis of the value of the coefficient of regression.

Work Plan-

The patient satisfying the selection criteria will be included in the study. After taking informed consent from the parents the babies will be included in the study. After making the diagnosis of pneumonia, detail history of the babies will be taken. Utmost care should be taken to evaluate antenatal, natal and post natal history. After proper history taking the babies will be clinically examined in details. Blood samples of babies will be drawn and CBC, sepsis screen and blood culture would be done. Along with these some base line investigation would be carried out like urea, creatinine, sodium, potassium, liver function test etc. These values will help in monitoring of the patient during the study period. Proper treatment should be started for the baby with antibiotic, IV fluid. Oxygen support should be given by hood box or by CPAP according to the respiratory rate and pattern of the baby. After 3 days of antibiotic and supportive therapy the baby will be assessed again whether the symptoms relieved or not, whether the general condition of the baby improved or not etc. A chest X-Ray will be taken and blood samples will be drawn. Analysis of the X-Ray and blood samples to be done. On day 7 of antibiotic therapy the same procedure will be done again. The results will be plotted on table and statistical analysis will be done accordingly.

Statistical Analysis:

For statistical analysis data were entered into a Microsoft excel spreadsheet and then analyzed by SPSS 24.0. and GraphPad Prism version 5. Data had been summarized as mean and standard deviation for numerical variables and count and percentages for categorical variables. Two-sample t-tests for a difference in mean involved independent samples or unpaired samples. Paired t-tests were a form of blocking and had greater power than unpaired tests. One-way analysis of variance (one-way ANOVA) was a technique used to compare means of three or more samples for numerical data (using the F distribution). A chi-squared test ($\chi 2$ test) was any statistical hypothesis test wherein the sampling distribution of the test statistic is a chi-squared distribution when the null hypothesis is true. Without other qualification, 'chi-squared test' often is used as short for Pearson's chi-squared test. Unpaired proportions were compared by Chi-square test or Fischer's exact test, as appropriate.

Explicit expressions that can be used to carry out various *t*-tests are given below. In each case, the formula for a test statistic that either exactly follows or closely approximates a *t*-distribution under the null hypothesis is given. Also, the appropriate degrees of freedom are given in each case. Each of these statistics can be used to carry out either a one-tailed test or a two-tailed test.

Once a *t* value is determined, a *p*-value can be found using a table of values from Student's t-distribution. If the calculated *p*-value is below the threshold chosen for statistical significance (usually the 0.10, the 0.05, or 0.01 level), then the null hypothesis is rejected in favour of the alternative hypothesis.

p-value ≤ 0.05 was considered for statistically significant.

RESULT AND ANALYSIS

Number of neonates admitted in the study period 6952 out of which 1529(22%) were diagnosed as pneumonia.Out of the 250 neonates of the study group 161(64.4%) were blood culture negative and 89(35.6%) were culture positive on D1.Gram negative bacteria was predominantly found on culture. Klebsiella found in 30(33.7%), E.Coli 19(21.3%), Staph.aureas 18(20.2%), Streptococcus Sp. 14(15.7%), Enterococcus 5(5.6%) and Candida found in 3(3.4%) cases .

Distribution Of Means Of TLC, Neutrofil, Platelets, CRP And mESR In Three Days Of Investigation

The mean TLC (mean± s.d.) of patients was 8158.0000 ± 1919.8488/ cu.mm at day 1 with range 2000.0000 - 14000.0000/cu.mm and the median was 8100.0000/cu.mm. At day 3, The mean TLC (mean± s.d.) of patients was 8792.0000 ± 3098.5578/cu.mm with range 2000.0000 - 14200.0000/cu.mm and the median was 9400.0000/cu.mm. At day 7, The mean TLC (mean± s.d.) of patients was 6480.8000 ± 3391.3236/cu.mm with range 1600.0000 - 14600.0000/ cu.mm and the median was 6200.0000/cu.mm. Association of TLC in three day investigation was statistically significant ($p<0.0001$).

The mean Neutrofil (mean± s.d.) of patients was 2447.4000 ± 575.9546/cu.mm at day 1, with range 600.0000 - 4200.0000/cu.mm and the median was 2430.0000/cu.mm. At day 3, The mean Neutrofil (mean± s.d.) of patients was 4396.0000 ± 1549.2789/cu.mm with range 1000.0000 - 7100.0000/cu.mm and the median was 4700.0000/cu.mm. At day 7, The mean Neutrofil (mean± s.d.) of patients was 3240.4000 ± 1695.6618/cu.mm with range 800.0000 - 7300.0000/ cu.mm and the median was 3100.0000/cu.mm. Association of Neutrofil in three day investigation was statistically significant ($p<0.0001$).

At day 1, the mean Platelets (mean± s.d.) of patients was 2.8999 ± .9514 lacs/ cu.mm with range 0.4100 -4.2000 lacs/cu.mm and the median was 3.1000 lacs/cu.mm. At day 3, the mean Platelets (mean± s.d.) of patients was 2.6202 ± 1.1114 lacs/cu.mm with range 0.3400 - 4.0000lacs/cu.mm and the median was 3.1000 lacs/cu.mm. At day 7, the mean Platelets (mean± s.d.) of patients was 2.7735 ± 1.0473 lacs/cu.mm with range 0.3200 -4.0000 lacs/cu.mm and the median was 3.2000 lacs/cu.mm. Association of Platelets in three day investigation was statistically significant ($p=0.0109$).

The mean CRP (mean± s.d.) of patients was 10.3412 ± 6.9612 mg/L with range 3.2000 - 34.0000 mg/L at day 1, and the median was 6.9000 mg/L. At day 3, the mean CRP (mean± s.d.) of patients was 8.9248 ± 6.4137 mg/L with range 3.2000 - 35.4000 mg/L and the median was 6.4000 mg/L. At day 7, the mean CRP (mean± s.d.) of patients was 7.7200 ± 5.5667 mg/L with range 3.2000 - 36.1000 mg/L and the median was 5.6000 mg/L. Association of CRP in three day investigation was statistically significant ($p<0.0001$).

Mean mESR at D1 (mean± s.d.) of patients was 5.8280 ± 5.7041 with range 1.0000 - 20.0000 and the median was 3.5000. At day 3, the mean mESR (mean± s.d.) of patients was 5.0160 ± 5.2526 with range 1.0000 - 20.0000 and the median was 2.0000.At day 7, the mean mESR (mean± s.d.) of patients was 5.6960 ± 5.9681 with range 1.0000 - 20.0000 and the median was 2.0000. Association of mESR in three day investigation was not statistically significant ($p=0.2267$)..

Chest X ray

While analyzing the chest x ray we found On D1, 137(54.8%) patients had one patch involvement, 55(22.0%) patients had one lobe involvement, 27(10.8%) patients had two lobe involvement, 28(11.2%) patients had one side whole lung involvement and 3(1.2%) patients had diffuse bilateral involvement. In chest Xray on D3, 88(35.2%) patients had increased severity and 162(64.8%) patients had decreased severity. In chest Xray on D7, 72(28.8%) patients had increased severity and 178(71.2%) patients had decreased severity.

Table 1: Distribution Of Chest X Ray D1 Vs Chest X Ray D3

CHEST X-RAY D3			
Chest Xray D1	Increased	Decreased	TOTAL
One Patch Row % Col %	46 33.6 52.3	91 66.4 56.2	137 100.0 54.8
One Lobe Row % Col %	19 34.5 21.6	36 65.5 22.2	55 100.0 22.0
Two Lobe Row % Col %	9 33.3 10.2	18 66.7 11.1	27 100.0 10.8
One side whole lung Row % Col %	11 39.3 12.5	17 60.7 10.5	28 100.0 11.2
Diffuse bilateral Row % Col %	3 100.0 3.4	0 0.0 0.0	3 100.0 1.2
TOTAL Row % Col %	88 35.2 100.0	162 64.8 100.0	250 100.0 100.0

Chi-square value: 5.9375; **p-value:** 0.2039

On D1, the group who have one patch involvement, on day 3 severity increased in 33% and decreased in 67%. Of the group one lobe, on day 3, severity increased in 35% cases and decreased in 65%. Of the group two lobe involvement, on day 3 severity increased in 33% and decreased in 67%. Of the group one side whole lung lesion, on day 3, severity increased in 40% and decreased in 60%. Of the group diffuse bilateral involvement all the cases had increased severity on day 3

Table 2: Distribution Of Mean TLC In D1 And D3 For Chest X-ray D3 Increased Patients

		Number	Mean	SD	Minimum	Maximum	Median	p-value
TLC	Day 1	88	8051.1364	2217.1740	2000.0000	14000.0000	7800.0000	<0.0001
	Day 3	88	5270.4545	1548.7599	2000.0000	10000.0000	5400.0000	

At day 1, the mean TLC (mean± s.d.) of patients was 8051.1364 ± 2217.1740/ cu.mm with range 2000.0000 - 14000.0000/ cu.mm and the median was 7800.0000 /cu.mm. At day 3, the mean TLC (mean± s.d.) of patients was 5270.4545 ± 1548.7599/ cu.mm with range 2000.0000 - 10000.0000/ cu.mm and the median was 5400.0000 /cu.mm. Association of TLC in D1 and D3 for Chest X-Ray D3 increased patients was statistically significant (p<0.0001).

Table 3: Distribution Of Mean Platelets In D1 And D3 For Chest X-ray D3 Increased Patients

		Number	Mean	SD	Minimum	Maximum	Median	p-value
Platelets	Day 1	88	2.7590	1.0137	0.4100	4.2000	3.1000	<0.0001
	Day 3	88	1.2710	.6879	0.3400	3.2000	1.1000	

At day 1, the mean Platelets (mean± s.d.) of patients was 2.7590 ± 1.0137 lacs/ cu.mm with range 0.4100 -4.2000 lacs/cu.mm and the median was 3.1000 lacs/cu.mm. At day 3, the mean Platelets (mean± s.d.) of patients was 1.2710 ± .6879 lacs/cu.mm with range 0.3400 - 4.0000 lacs/cu.mm and the median was 1.1000 lacs/cu.mm. Association of Platelets in D1 and D3 for Chest X-Ray D3 increased patients was statistically significant (p<0.0001).

Table 4: Distribution Of Mean CRP In D1 And D3 For Chest X-ray D3 Increased Patients

		Number	Mean	SD	Minimum	Maximum	Median	p-value
CRP	Day 1	88	10.8784	7.6322	3.2000	34.0000	6.9000	0.0703
	Day 3	88	13.0193	7.9607	4.5000	35.4000	9.6500	

At day 1, the mean CRP (mean± s.d.) of patients was 10.8784 ± 7.6322 mg/L with range 3.2000 - 34.0000 mg/L and the median was 6.9000 mg/L. At day 3, the mean CRP (mean± s.d.) of patients was 13.0193 ± 7.9607 mg/L with range 4.5000 - 35.4000 mg/L and the median was 6.4000 mg/L.

Association of CRP in D1 and D3 for Chest X-Ray D3 increased patients was not statistically significant (p=0.0703).

Table 5: Distribution Of Mean TLC In D3 And D7 For Chest X-ray D7 Increased Patients

		Number	Mean	SD	Minimum	Maximum	Median	p-value
TLC	Day 3	72	8533.3333	3192.5971	2000.0000	14200.0000	8800.0000	<0.0001
	Day 7	72	3500.0000	1017.0380	1600.0000	6000.0000	3600.0000	

At day 3, the mean TLC (mean± s.d.) of patients was 8533.3333 ± 3192.5971 /cu.mm with range 2000.0000 - 14200.0000 /cu.mm and the median was 8800.0000 cu.mm. At day 7, the mean TLC (mean± s.d.) of patients was 3500.0000 ± 1017.0380 /cu.mm with range 1600.0000 - 6000.0000 /cu.mm and the median was 3600.0000 /cu.mm. Association of TLC in D3 and D7 for Chest X-Ray D7 increased patients was statistically significant (p<0.0001).

Table 6: Distribution Of Mean Platelet In D3 And D7 For Chest X-ray D7 Increased Patients

		Number	Mean	SD	Minimum	Maximum	Median	p-value
Platelet	Day 3	72	2.6965	.9958	0.4000	3.1000	3.1000	<0.0001
	Day 7	72	1.3150	.7229	0.3200	1.1000	1.1000	

At day 3, the mean Platelets (mean± s.d.) of patients was 2.6965 ± .9958 lacs/cu.mm with range 0.4000 -3.1000 lacs/cu.mm and the median was 3.1000 lacs/cu.mm. At day 7, the mean Platelets (mean± s.d.) of patients was 1.3150 ± .7229 lacs/cu.mm with range 0.3200 - 1.1000 lacs/cu.mm and the median was 1.1000 lacs/cu.mm. Association of Platelets in D3 and D7 for Chest X-Ray D7 increased patients was statistically significant (p<0.0001).

Table 7: Distribution Of Mean CRP In D3 And D7 For Chest X-ray D7 Increased Patients

		Number	Mean	SD	Minimum	Maximum	Median	p-value
CRP	Day 3	72	10.3486	7.8017	3.2000	35.0000	6.6500	0.0908
	Day 7	72	12.4903	7.2820	4.6000	36.1000	11.0000	

At day 3, the mean CRP (mean± s.d.) of patients was 10.3486 ± 7.8017 mg/L with range 3.2000 - 35.0000 mg/L and the median was 6.6500 mg/L. At day 7, the mean CRP (mean± s.d.) of patients was 12.4903 ± 7.2820 mg/L with range 4.6000 - 36.1000 mg/L and the median was 11.0000 mg/L.

Association of CRP in D3 and D7 for Chest X-Ray D7 increased patients was not statistically significant (p=0.0908).

DISCUSSION

According to the objectives of the study, we get the following.

1. Incidence of pneumonia is 22% of the hospitalised neonates in the study setting. Most of the patients (57%) diagnosed with neonatal pneumonia have early onset neonatal sepsis. 66% of them had history of premature rupture of membrane > 24 hours. The mean period of gestation is 32.9 weeks, so majority of them are preterm. 30% of them had history of birth asphyxia.
2. The established etiology of pneumonia is mainly bacteriological. Blood culture has come positive in 36% of the cases. Of the positive cases 28% cases has meningitis. The isolated organisms are namely-
   Klebsiella sp 34%
   E. coli 22%
   Staph aureus 20%
   Streptococcus sp 16%
   Candida 3.4%
3. On studying the haematological parameters the following features are found-
   a) There is no major difference in haemoglobin value in the 3 days of investigation.
   b) The mean TLC is increased on day 3 and later decreased on day 7. Absolute neutrophil count showed similar trend.
   c) There is gradual decrease of mean lymphocyte count over the 3 days of investigation.
   d) There is no significant change in mean platelet count over the 3 days of investigation.
   e) There is gradual decrease of mean CRP level over the course of the treatment
   f) There is no significant change of mESR
   g) Mean urea and mean creatinine values are slightly on the higher side on day 1.
4. The radiological feature which is most commonly found is alveolar infiltrates. The patients are divided in five groups according to severity of chest X-ray.

a) In 35 % cases the severity of chest X-ray is increased on day 3 in respect to day 1. Their mean TLC is decreased on day 3 in comparison to day 1. Their mean platelet count is decreased on day 3. But there is no significant change in mean CRP value on day 3 with respect to day 1.

b) In 28% cases the chest X-ray severity is increased on day 7 in respect to day 3 finding. Here also the mean TLC and mean platelet count decreases on day 7 in comparison to day 3. There is no significant change in mean CRP level in respect to day 3.

CONCLUSION

In this study newborns diagnosed with pneumonia according to chest X-ray finding has been studied in a tertiary care setup. Majority of the subjects were preterm. Quite a few of them has history of premature rupture of membrane and birth asphyxia. There is gradual decrease in the CRP value over the period of time in the disease process. The mean TLC of the patients increased on day 3, but if the TLC is considered of the group whose chest X-ray severity is increased on day 3 then the mean value decreased. The mean platelet count is also decreased of the said group, but there is no significant change of CRP value. Similar finding is found in day 7 chest X-ray severity increased patients. The mean TLC and mean platelet count is decreased but there is no significant change in CRP value. So according to results of this study the prognosis of neonates with pneumonia can be assessed by serial TLC and platelet count evaluation. The need for repeated X-ray radiation can be minimised.

Some limitations are also there in this study. Only the cases admitted in a tertiary care hospital are evaluated, so the large community scenario may be different.

This study has been done in a tertiary care hospital with 250 samples with ages between 1 to 14 days and gestational age between 28 weeks to 42 weeks. This study should be followed up and should be performed on a larger cohort to establish a proper relationship between chest X-ray finding and haematological parameters in the disease process.

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