

CHEST RADIOGRAPHS IN NEONATAL SEPTICEMIA

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ABSTRACT

Chest radiographs of 63 culture proven cases of neonatal septicemia were evaluated in this prospective study. Gram negative septicemia was responsible for 76.2% cases. Radiological abnormalities were observed in 27 cases (42.8%). Seven of these had no respiratory distress. The findings were right sided infiltrates (27%); hyperinflation (7.9%), bronchopneumonia (6.3%) and pneumothorax (1.6%). Increasing gestational age, late onset of illness (>3 days) and presence of respiratory signs of distress had a positive correlation with presence of X-ray findings. Term newborns with respiratory distress of late onset sepsis (>3 days) had significantly higher number ($p < 0.05$) of abnormal radiographs. Presence of radiological abnormality neither influenced the clinical outcome nor was affected by the causative organisms. The practice of doing a chest radiograph routinely in cases of neonatal septicemia is justified irrespective of presence of respiratory signs of distress.

Key words: Newborn, Septicemia, Radiography.

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A chest radiograph, believed to be a valuable diagnostic tool, is indicated in all neonates having non-specific signs of infection and has been advocated as an integral part of septic workup of a newborn(1,2). Though the usefulness of chest radiographs in a pediatric ICU has been evaluated earlier(3), the clinical utility and diagnostic efficacy of doing routine chest radiographs in neonatal septicemia has not been studied. Moreover, concern over cumulative radiation dose, rising cost of X-ray films and manpower involved have led to increased scrutiny of such routine examinations. The present study was therefore, undertaken to justify the role of routine chest radiography and to relate roentgenic abnormalities to clinico-bacteriological profile in cases of bacteriologically proved septicemic newborns.

Material and Methods

Chest radiographs and clinical details of 63 children with bacteriologically proved neonatal septicemia who were admitted to the Special Care Baby Unit of GTB Hospital between 1st January and 30th September 1991 constituted the material for this prospective study. Clinical details related to sex, birth weight, gestation, day of onset, presence of respiratory signs of distress and outcome were recorded in a separate proforma. The respiratory sign of distress was taken as presence of one or more of following: respiratory rate (RR) >60, chest retractions, nasal flaring, grunting, rales, apnea and/or cyanosis, as defined by Heulitt *et al.*(4). Cases having respiratory distress arising due to causes, such as severe asphyxia, hyaline membrane disease, meconium aspiration and transient tachypnea of newborn, etc. were not included in the present study. Routine septic workup including blood culture and chest radiograph were

done in all cases. All X-rays were reported by a single person to minimize inter-observer bias. The radiologist had no knowledge of patient's identity, clinical history and bacteriology reports.

Only those cases with bacteriologically proved septicemia were analysed for further study. Four cases were excluded from the study because of poorly exposed films. In the remaining 63 cases, presence of abnormal radiographs was correlated to sex, birth weight, gestation, presence of respiratory sign of distress, day of onset of illness, causative organism and clinical outcome.

Results were analysed using chi square test. The cases were further subjected to hierarchical log linear analysis. Standard residuals corresponding to each subcategory were obtained and were checked whether they exceed 1.96 or not at which p is <0.05 . This analysis presumes reasonably large number of cases in each subcategory so that the assumption of normality holds. In our series, the number of cases were not very large, yet the violation due to slightly less number of cases may not be serious. The statistical analysis was carried out using SPSS software package on compatible IBM PC/AT 386 computer.

Results

Abnormalities in chest radiographs

were detected in 27 out of 63 cases (42.8%). Right sided infiltration was present in 17 (27%), hyperinflation in 5 (7.9%), extensive bilateral pneumonia in 4 (6.3%) and pneumothorax in one case, respectively. Gram negative bacteria were isolated in 48 cases (76.2%). *Klebsiella* was the commonest organism (36.5%). Right sided infiltration was the commonest abnormality noticed in *Klebsiella* septicemia while hyperinflation was noticed to be a characteristic feature of *pseudomonas*. Radiological features of various isolates are listed in *Table I*.

Correlation of abnormal radiographs with various clinical parameters and causative organisms along with results of hierarchical log linear analysis are shown in *Table II*.

Discussion

Besides the clinical and laboratory evaluation, chest roentgenogram provides useful information regarding diagnosis and management of the patients. Chest radiography of neonates is a safe procedure and does not provide radiation hazard to the baby(5). The incidence of positive radiological findings in neonatal septicemia varies from 50 to 100%(6-8). Pneumonitis and hyperinflation are the commonest radiological findings, though there is no specific

TABLE I—Radiological Features of Various Isolates

Organisms	Normal	Right infiltrates	Hyperinflation	Broncho-pneumonia	Pneumo-thorax
<i>Klebsiella</i>	10	10	1	2	—
<i>E. coli</i>	7	2	—	—	—
<i>Staph. aureus</i>	2	1	—	2	1
<i>Pseudomonas</i>	4	—	4	—	—
<i>Strept. fecalis</i>	1	4	—	—	—
Others	12	—	—	—	—

TABLE II—Relationship of Abnormal Chest Radiographs with Various Clinical Parameters and Causative Organisms

Parameter	(A) Chest radiograph	
	(a) Normal (n = 36)	(b) Abnormal (n = 27)
(B) Sex		
(a) Male	24	18
(b) Female	12	9
(C) Gestation		
(a) Term	11	18 *
(b) Preterm	25	9
(D) Weight		
(a) >2500 g	—	3
(b) LBW	36	24
(E) Resp. distress		
(a) Present	10	20 **
(b) Absent	26	7
(F) Day of onset		
(a) ≤ 3 days	23	10
(b) >3 days	13	17 ***
(G) Outcome		
(a) Improved	27	19
(b) Died	9	8
(H) Causative organism		
(a) <i>Klebsiella</i>	10	13
(b) <i>E. coli</i>	7	2
(c) <i>Staph. aureus</i>	2	4
(d) <i>Pseudomonas</i>	4	4
(e) <i>Strept. fecalis</i>	1	4

* p = <0.01, ** p = <0.001 *** p = 0.06 (marginally significant) (with Yate's correction)

Results of Hilog Linear Analysis

Done for	Significant at p < 0.05
A vs C and E	A(b) → [C(a) → E(a)]
A vs C and F	A(b) → [C(a) → F(b)]
A vs E and F	A(b) → [E(a) → F(b)]

pulmonary pattern(9). It is not usually possible to determine the etiology of neonatal pneumonia from chest film but presence of pneumatoceles or pneumothorax is a pointer towards staphylococcal origin(1). In the present study as well, no relationship was observed between the causative organism and radiological abnormalities. However, pneumothorax was detected in one case of staphylococcal septicemia. Interesting observations were made when radiological abnormalities were correlated with various clinical parameters. Sex and weight of the baby did not affect the radiological findings. Increasing gestational age, late onset of illness (>3 days) and presence of respiratory signs of distress had a positive correlation with abnormal radiological findings. Poor immune status in early days of life probably accounted for non-localization of infection to the respiratory system in preterms.

Hierarchical log linear analysis was carried out on contributory variables but due to paucity of cases, all variables could not be studied simultaneously. However, it was noticed that term babies with either respiratory distress or late onset disease had more radiological abnormalities as compared to other subgroups.

One obvious issue is that whether omission of chest radiograph, when there is no sign of respiratory distress in cases of neonatal septicemia, subjects these patients to a significant risk or not. In the present series 7 out of 33 babies (21.2%) not having any respiratory signs of distress had positive findings in a chest radiograph. Though the management of the cases was not affected by positive radiological findings (except in one case with pneumothorax), yet from diagnostic point of view, it is imperative to do a chest radiograph in all patients of neonatal septicemia whether

they have signs of respiratory distress or not.

To conclude, chest X-ray is a useful procedure in cases of neonatal septicemia and should be continued as a routine in these cases irrespective of presence of respiratory signs of distress. The diagnostic efficacy clearly outweighs the cost factor and administrative problems involved.

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