

CONGENITAL PNEUMONIA AND PNEUMONIA IN THE NEONATAL PERIOD

AN ANALYSIS OF 84 CASES EXAMINED AT NECROPSY

BY

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Pneumonia is relatively often found at necropsy in stillborn infants and infants dying in the neonatal period. Ahvenainen (1951) found microscopical evidence of pneumonia in 14 of 45 stillborn infants; Arey and Dent (1953) demonstrated pneumonia at necropsy in 31% of 123 infants who died in the neonatal period, and Barter (1953) in 19% of 131 infants who died within six hours of birth. The problems of pneumonia in this age group have recently been discussed in *The Lancet* (Annotation, 1954) and have been treated editorially in *The Journal of Pediatrics* (Blattner, 1953).

In order to assess more closely the importance of pneumonia at this age, the authors have re-examined the necropsy material from the Institute of Pathological Anatomy, University of Oslo. It is the purpose of this paper to give the statistical data of this investigation, and to discuss the findings.

The Material

This consists of 422 consecutive necropsies, namely, all newborn infants sent for necropsy during the six-year period 1948-1953 inclusive. Of these infants, 169 were stillborn and 253 died within the first 30 days of life. We have personally re-examined all microscopical slides of these cases. At necropsy slides were prepared from the heart, liver, kidneys, pancreas, thymus and thyroid gland, and usually four slides from the lungs of each infant. The stain used was haematoxylin and eosin, in some cases supplemented by other stains. The criterion for the diagnosis of pneumonia has been the finding of a marked accumulation of polymorphs in the lung alveoli and the parenchyma.

Results

The distribution of the cases of pneumonia among all infants examined is shown in Table 1. The high

TABLE 1
INCIDENCE OF PNEUMONIA IN DIFFERENT WEIGHT GROUPS

	Weight at Birth (g.)	No. of Infants Examined	No. of Cases with Pneumonia
Stillborn infants (total 169)	<2,500	57	1 (2%)
	2,500-4,000	88	8 (9%)
	>4,000	24	7 (29%)
Born alive (total 253)	<2,500	102	29 (28%)
	2,500-4,000	129	34 (26%)
	>4,000	22	5 (23%)
Total		422	84 (20%)

incidence (29%) of pneumonia in the heaviest group of stillborn infants is striking.

Fig. 1 shows the distribution of the 84 cases of pneumonia according to weight at birth and age at death. The distribution in relation to birth weight shows the same peculiar feature as in Table 1, i.e., pneumonia in the stillborn is seen particularly in large infants. Their average birth weight was 3.9 kg.

Table 2 illustrates this factor in more detail. It will be seen here that stillborn infants with pneumonia weighed, on an average, 0.9 kg. more than stillborn infants in whom no pneumonia was demonstrable. In infants who lived for more than one week, the relation appears to be reversed, i.e., infants in whom pneumonia was observed weighed,

TABLE 2
AVERAGE BIRTH WEIGHT IN CASES OF PNEUMONIA

	Stillborn	Died within 1 to 7 Days	Died within 8 to 30 Days
Cases with pneumonia (84)*	3.9 kg. (16)	3.0 kg. (56)	2.7 kg. (12)
Cases without pneumonia (338)	3.0 kg. (153)	2.87 kg. (158)	3.1 kg. (27)

* No. of cases in brackets.

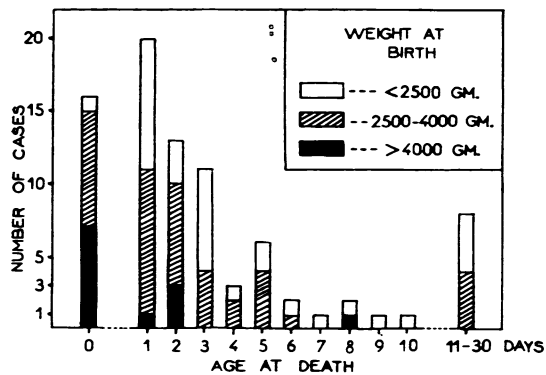


FIG. 1.—The distribution of 84 cases of pneumonia according to weight at birth and age at death.

on an average, 0.4 kg. less than those without demonstrable pneumonia.

Table 3 shows the data regarding pregnancy and labour of the mothers of 16 stillborn infants with pneumonia. It is evident that the sequence was most frequently that of an elderly primipara with an especially large infant, prolonged labour and symptoms of intra-uterine infection. Of the 16 mothers, 15 were primiparae, 12 of them 28 years old or more.

An analysis of the 33 infants who died during the first two days of life, and in whom pneumonia was found, discloses that in 13 cases rupture of the membranes occurred at least six hours before

delivery; nine of these were elderly primiparae with febrile labour and large infants. In 12 of the remaining cases there was a history of late rupture, i.e., within the last 20 minutes before delivery. In these cases there was no increase in incidence of elderly primiparae, the delivery being normal in the majority of cases. The post-mortem diagnosis of pneumonia in these 12 infants came as a surprise. There were several examples of massive pneumonia in infants who died 15 to 20 hours after birth. This was most frequently found in premature infants.

We have also endeavoured in our material to clarify the mode of pulmonary infection in newborn infants. On detailed analysis of infants with pneumonia who died during the first three days, these may be divided into two distinct groups according to the mode of infection, as illustrated in Fig. 2. The infants who were probably infected as a result of aspiration of contaminated amniotic fluid had an average birth weight of 3.60 kg. The infants probably infected after delivery had an average birth weight of 2.46 kg., half the number being premature.

Discussion

It should be noted that the figures and tables are prepared from post-mortem material and do not, therefore, give any definite information on the incidence of pneumonia among surviving infants in the same period. Neither has the question been solved whether pneumonia was the actual cause of

TABLE 3
DATA ON 16 STILLBORN INFANTS WITH PNEUMONIA

Necropsy No.	Age of Mother	Parity	Temperature (° C.) of Mother before Delivery (in axilla)	Rupture of Membranes before Birth	Therapy before Birth	Birth Weight (g.)
10/48	35	1	38.4	6 days	Penicillin	4,000
21/49	37	1		Foul odour Same day		4,810
39/49	20	1		Cloudy		3,790
43/49	33	1	Febrile 3 days	2 days At delivery		4,280
114/49	26	1		Cloudy		4,930
11/50	24	1	38.5	5 days Over 1 day	Streptomycin	4,620
50/51	41	1	37.8	Cloudy		
52/51	32	1	Subfebrile	1½ day Foul odour	Penicillin	2,600
18/52	36	1	38.9	3½ days	Penicillin - streptomycin	3,870
49/52	30	1		4 days	Penicillin - streptomycin	3,900
55/52	33	1	37.9	1 day 2½ day		1,700 3,900
66/52	37	1		Foul odour 1½ days	Penicillin - streptomycin	5,040
8/53	26	1		Over 1 day		2,940
20/53	40	2		5 hours		4,200
49/53	28	1		1 day Foul odour		3,630
37/53	29	1		7 days	Penicillin - streptomycin	3,900
Average ..	31.7					3,880

death or only a contributory factor. The fact that pneumonia is seen so frequently 'in the valley of the shadow of birth' (Smith, 1951), emphasizes the importance of an investigation in this field in order to reach effective prophylaxis and therapy.

Clifford (1954) has shown that elderly primiparae relatively often give birth to post-mature infants. Elderly primiparae also frequently have a com-

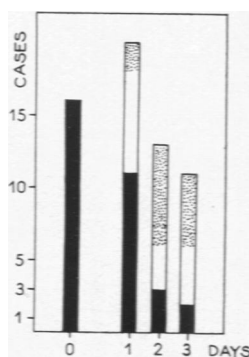


FIG. 2.—Stillborn infants and infants who died during first three days and in whom pneumonia was found (60 cases).

Black: infants probably infected before or during delivery.
 Dotted: probably airborne infection.
 White: obscure mode of infection.

plicated delivery. Post-maturity in itself, as well as the complications at birth, seems to involve an increased risk of massive intra-uterine aspiration. In these cases early rupture of the membranes often occurs (spontaneous or provoked). The aspirated amniotic fluid is frequently contaminated, providing a possible risk of intra-uterine pneumonia. Thus, the correlation shown here between elderly primiparae, large infants and pneumonia of intra-uterine origin, does not seem to depend on any chance coincidence. It follows that prophylactic antibiotic treatment is specially indicated in elderly primiparae.

The clinical diagnosis of pneumonia in the newborn is difficult, as confirmed in this material. The physical findings have been inconclusive, and in

many cases x-ray and blood examinations fail to contribute to the diagnosis. Another feature complicating the diagnosis is the normal presence in this age group of a leucocytosis with a shift to the left. Antibiotic treatment of the infants should, therefore, be instituted even on suspicion alone, and should be directed against the micro-organisms empirically known to be active in intra-uterine and airborne infection respectively. In an attempt to clarify which micro-organisms are most frequently causative in these pulmonary infections, we have recently been performing puncture of the lungs through the thoracic wall as soon as possible after death. Results of these studies are not yet available.

Summary

In post-mortem material comprising 169 stillborn infants and 253 infants who died in the neonatal period, pneumonia was observed in 84 infants, 60 of whom were stillborn or died within the three first days.

These 60 cases have been distributed into two main groups: (1) infants infected before or during delivery. Most of these were large infants, and the mothers were, as a rule, elderly primiparae. (2) Infants probably infected after delivery by airborne infection: half of these were premature. Massive pneumonia was seen in premature infants dying during the first day, even after entirely normal births.

The prophylactic treatment of mother and child should be planned to combat both these two modes of infection.

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REFERENCES

- Ahvenainen, E. K. (1951). *Acta paediat., Uppsala*, 40, 1.
 Annotation (1954). *Lancet*, 1, 506.
 Arey, J. B. and Dent, J. (1953). *J. Pediat.*, 42, 205.
 Barter, R. (1953). *J. Bact. Path.*, 66, 407.
 Blattner, R. J. (1953). *J. Pediat.*, 43, 112.
 Clifford, S. H. (1954). *Ibid.*, 44, 1.
 Smith, C. A. (1951). *Amer. J. Dis. Child.*, 82, 171.