

NEONATAL TUBERCULOSIS*

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Cases of congenital and neonatal tuberculosis are well documented in the literature,¹⁻⁶ but are nevertheless uncommonly found in both hospital and domiciliary practice. Horley¹ reviewed 18 cases of congenital tuberculosis in the literature and added a further case of his own. Hudson² described a case of congenital tuberculosis in an infant born of a mother suffering from pulmonary tuberculosis. This baby was isolated from its mother immediately after birth and was given BCG on the second day of life. Despite these measures, it developed pulmonary tuberculosis on the 18th day of life but made a successful recovery on treatment with streptomycin and INH.

In order to diagnose congenital tuberculosis, the criteria laid down by Beitzke⁶ in 1935 must be fulfilled, viz.: active tuberculosis in the mother, active tuberculosis in the neonate, and no other source of tuberculosis than the mother. In such a case the infection may be acquired *in utero* or during passage through the birth canal at the time of delivery.

Neonatal tuberculosis, however, does not demand these criteria, and infection may be acquired following exposure to *M. tuberculosis* from a number of sources, either at home or in hospital. For this reason, mouth to mouth respiration for resuscitating newborns is to be condemned for fear of introducing pathogenic organisms into the infant's respiratory tree. This was well shown by the work of Frazer⁷ in 1951. Premature infants especially present a fertile field for sowing the seeds of infection in this manner.

CASE REPORTS

Between July and November 1967, 3 cases of neonatal tuberculosis were diagnosed at the Red Cross War Memorial Children's Hospital. In 2 of the children (cases 1 and 2), radiological evidence of bronchopneumonia was present in the neonatal period at the age of 10 days and 12 days, respectively, while these changes were present in the third child (case 3), at the age of 6 weeks. A tuberculous basis was not suspected in 2 patients (cases 2 and 3), and was only shown at postmortem examination, while in the third (case 1) the correct diagnosis was made and the appropriate therapy was commenced.

All 3 infants had been treated on intermittent positive-pressure respiration (IPPR); 2 because of neonatal tetanus (cases 1 and 2) and the third for respiratory failure due to an overwhelming bronchopneumonia.

None of the three patients had received BCG inoculation, and no family history of tuberculosis was found.

Case 1

I.V.N., an eighth child, was born at home unattended. His birthweight was 6 lb. 3½ oz. He was admitted aged 3 days having developed generalized spasms and difficulty in feeding on the day of admission. On examination, the baby was found to have tetanus neonatorum. Tracheostomy was performed on admission and curare and hyalase were given

intramuscularly *p.r.n.* ATS 20,000 IU was given intravenously and the same amount intramuscularly on admission. Gammaglobulin 1 ml. intramuscularly, KCl orally ½ G *t.d.s.* and daily penicillin intramuscularly and streptomycin intramuscularly for one week comprised the full medication. IPPR was begun immediately.

Ten days after admission X-ray of the chest showed bilateral patchy consolidation with flaring from both hilar areas and involvement of the upper and lower lobes, especially on the right. The baby recovered from the tetanus and was taken off the IPPR after 6 weeks. Serial X-rays of the chest taken over the next 3 months showed no change despite treatment with Penbritin and Orbenin, gentamicin and chloramphenicol.

At the age of 3½ months the Heaf test was found to be positive, and the 2nd-strength PPD 3 days later was strongly positive. The ESR was then 65 mm. in the first hour. Gastric washings, guinea-pig inoculation and Kirschner culture all failed to demonstrate *M. tuberculosis*. The diagnosis of pulmonary tuberculosis seemed to be almost certain, and treatment with streptomycin and INH was instituted. He was discharged aged 4½ months to a convalescent home progressing satisfactorily. Throughout his hospital stay the baby's general condition remained good and weight gain was satisfactory. Coughing was minimal, and only occasional rhonchi were heard in the right chest. X-ray of the chest of the mother and father showed no evidence of tuberculosis.

Case 2

M. de W. was delivered at home by a midwife. The baby's birthweight was 3 lb. 2¼ oz. and he developed generalized spasms and inability to feed at 5 days and was therefore admitted to hospital.

On examination the baby was found to be moderately jaundiced and hypothermic, with frequent generalized spasms and opisthotonos. The umbilical cord appeared septic. The liver was 2 fingers, and the spleen 1 finger-breadth below the costal margin. The diagnosis of tetanus neonatorum was made and tracheostomy was performed with subsequent IPPR, curarization, penicillin and streptomycin intramuscularly for one week, KCl ½ G *t.d.s.* orally for one week and ATS 20,000 IU intramuscularly and also intravenously. Gammaglobulin 1 ml. intramuscularly was also given.

The infant had recovered fully from the tetanus by the age of 6 weeks, but great difficulties were experienced in weaning this child off IPPR. At the age of 12 days an X-ray of the chest showed bilateral generalized bronchopneumonia. This increased in severity over the next 2 weeks, involving especially the upper lobes. The child was treated with courses of Penbritin and Orbenin, gentamicin and chloramphenicol. A bronchogram done 9 weeks after admission showed no narrowing of the trachea or bronchi. Gastro-enteritis due to *E. coli* type 0111/84 supervened and the patient died 3½ months after admission. A Heaf test was not done as pulmonary tuberculosis was not

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suspected. A postmortem examination revealed solid infective bronchopneumonic lungs with a primary tuberculous complex on the left side, involving the left lung, with caseation of the nodes at the bifurcation of the trachea and above it. Histological examination of the lungs showed caseous tuberculosis with slight extension from the primary focus by continuity. There were large numbers of *M. tuberculosis* confined to the area of caseation.

Case 3

S.Z., a 5-week-old premature infant, weighed 4 lb. 13½ oz. on admission. Born at home, she had not received BCG and no family history of tuberculosis was elicited, although there was a history of a cough 2 weeks before admission.

Examination showed a small, ill, hypothermic infant, tachypnoeic and with mild peripheral cyanosis. There was markedly diminished air entry in the lingular and left upper lobe areas, with diffuse bilateral crepitations. X-ray of the chest showed severe bilateral consolidation, more marked on the right. She was treated with Penbritin and Orbenin, but her general condition deteriorated and a tracheostomy was performed and IPPR started 48 hours after admission. Thick muco-pus from the trachea and bronchi was aspirated. There was no improvement on treatment and the child died 5 days after admission. Klebsiella organisms were isolated from the tracheal aspirate. A Heaf test was not done as tuberculosis was not suspected. Postmortem examination showed tuberculosis of the lungs, bronchogenic in nature, with miliary spread in both lungs and in the liver and kidneys. Histological examination of the lung tissue showed the presence of large numbers of tubercle bacilli.

DISCUSSION

Although the diagnosis of pulmonary tuberculosis was made at postmortem examination in cases 2 and 3, radiological evidence of pulmonary tuberculosis was present soon after admission to hospital in all 3 cases, at 13 days, 12 days and 5 weeks, respectively. However, due to the relative infrequency of tuberculosis at so young an age and to the circumstances briefly described above, routine Heaf testing and 2nd-strength PPD testing were only done in case 1. This resulted in strongly positive reactions, and antituberculous therapy was instituted. Exposure to tuberculosis most likely occurred at home in case 3, despite the absence of a family history of tuberculosis. However, this possibility could not be followed up further as the family could not be traced some weeks later.

In the 2 cases of tetanus neonatorum, exposure to tuberculosis may have occurred at home, but these infants were admitted at the ages of 3 days and 5 days, respectively, and a more likely source would be in hospital. This could have come from the nursing staff or the apparatus used for IPPR and aspirating secretions. A detailed list was made of all the nursing staff in the tetanus unit over this period. All had an X-ray of the chest taken during 1967, and they were shown to be free of pulmonary tuberculosis. All catheters are autoclaved before use. The most likely source is thus from the IPPR machine, especially as this has in the past presented a problem with regard to adequate sterilization. Campbell⁸ comments on the difficulty

of adequate sterilization of mechanical ventilators in use in an intensive care unit. Effective sterilization may be obtained by the use of ethylene-oxide gas being pumped in and around the apparatus, while Gullers⁹ recommends ultrasonically nebulized 70% ethyl alcohol passed through the respirator in a closed system for 2 hours to eliminate pseudomonas, *E. coli* and staphylococcal organisms. The humidifier is cleaned and heat-disinfected and filled with 0.1% hexachlorophene in water.

It is not uncommon for cases treated by tracheostomy and IPPR for conditions other than bronchopneumonia to acquire a lung infection. A variety of organisms is often cultured, both Gram-positive and Gram-negative, especially klebsiella and pseudomonas, and the possibility of *M. tuberculosis* causing the chest disease is often overlooked because of the youth of the patient. In order not to miss these cases when they occur, routine Heaf testing should be done on admission and repeated at intervals on all cases of pulmonary infections in infants and older children, especially where there is failure to obtain clinical and radiological resolution after adequate antibiotic therapy. It must be borne in mind, however, that the Heaf test only becomes positive about 6 weeks after infection with *M. tuberculosis*. Therefore the earliest age that this test would become positive in a postnatal infection would be 6 weeks, though with a congenital infection it might be positive before that. In the case of congenital tuberculosis reported by Arthur² a positive Heaf test was obtained in a neonate at the age of 22 days. In the Lübeck tragedy (1930) as reported by Böcher,¹⁰ live tubercle bacilli were mistakenly given to newborn infants, and positive reactions were obtained at the age of 23 days. Where a positive result is obtained in the absence of BCG inoculation, confirmatory tests, e.g. 2nd-strength PPD, Kirschner culture and guinea-pig inoculation, should be undertaken.

SUMMARY

Three instances of neonatal tuberculosis are recorded. Two of these are strongly suspected of having acquired the infection during the course of treatment for tetanus neonatorum while on IPPR. The possibility in neonates and infants of a bronchopneumonic process being tuberculous in nature is stressed; a serious infection of this nature should be borne in mind as a possible complication of IPPR.

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