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Review

PREMATURE RUPTURE OF MEMBRANES AND INTRAUTERINE INFECTION

by

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Premature rupture of membranes is a common obstetric complication, but its potential as a maternal and foetal hazard tends to be overlooked, especially in busy and overworked centres. This has led to a spate of literature on the subject over the last decade.

Definition: Premature rupture of membranes (PRM) is defined as the spontaneous rupture of membranes before the onset of labour. While some authors restrict the use of this term to rupture of the membranes before the 37th week of pregnancy (Burchell 1964), the general practice is to include all cases in which labour does not ensue within an hour of spontaneous rupture of membranes irrespective of the term of pregnancy (Greenhill 1966). Some inlcude only those in which labour has not ensued within 12 hours as it is generally agreed that the hazard is minimal till 12 hours have elapsed (Taylor 1961).

Incidence: This is cited as 2-15% according to the definition as labour ensuing within one hour, 12 hours or 24 hours, with an average of 10% (Kaplan 1963). Of these, about 60% are mature i.e. more than 36 weeks pregnant. In about 75% labour ensues shortly and progresses efficiently.

Diagnosis: In most cases the patient's report of leaking membranes can be confirmed by gross observation of passage of amniotic fluid through the cervical canal and its subsequent pooling in the posterior fornix when pressure is exerted on the uterine fundus (Russell 1962). When in doubt the diagnosis can be confirmed by

1. Alteration of pH of vaginal fluid by Nitrazine paper test (Baptisti 1938).
2. Arborisation test on vaginal fluid. (Callagan 1962).

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Factors that influence infection

(a) *Latent period and duration of labour:* Danger of infection to both mother and infant increases with the time that elapses between PRM and delivery. Lanier (1965), Calkins (1952) and Russell (1962) have however, set maximum time limits of 24 to 72 hours beyond which infection will not begin if it has not set in already.

The latent period tends to be correlated with the period of gestation (Eastman 1966, Shubeck 1966). Russell (1962) has shown that after 36 weeks' gestation, 80% are in labour within 24 hours while before 36 weeks' gestation only 50-70% are in labour before 48 hours. The chances of infection in premature infants are therefore greater. In a study by Pryles (1963) neonatal infection was suspected in 19% and proved in 7% with a latent period of 36 hours and suspected in 100% and proved in 50% with a latent period of 3-6 weeks. In the same study neonatal sepsis was suspected in 62% and proved in 20% of premature births as against suspicion in 11 per cent and proof in none of the mature births with a latent period of 24 hours. Prematurity, therefore, increases vulnerability to infection.

Active labour over 6 hours in the presence of PRM may be a factor in developing intrautrine sepsis (Nesbitt 1956). Pryles (1963) and Tyler (1966) found that duration of labour did not influence the incidence of infection in the new-born. The longer the latent period beyond 24 hours, the longer the first stage of labour (Kaplan 1963) and hence it is not always possible to study the effect of each individually.

(b) *Organisms in Vagina and Cervix and Vaginal Examination:* Potentially pathogenic bacteria were found in the cervix throughout pregnancy without regard to socio-economic status (White 1968). Vaginal examination is more likely to carry them into the endocervix. Peterson (1965) found that the danger of PRM did not appear to be increased by routine vaginal examination but the consensus of opinion is to avoid vaginal examination if it is hoped to gain more time in utero for the foetus. According to Brelje (1966) amnionitis is seen all too often without the growth of pathogenic organisms in the vagina.

Laboratory data used to identify infected infants: These have been explored to assess the risk of infection and to avoid the indiscriminate use of antibiotic treatment in the new-born. They are

(a) Identification of similar enteric bacteria in maternal vagina and infant's respiratory tract (Morison 1952).

(b) Leucocytic infiltration of umbilical vein in umbilical cord (Benirschke 1959).

(c) Cord blood cultures (Pryles 1963).

(d) Leucocytes and bacteria in infants' gastric aspirate (Blanc 1959).

(e) Histology of amnion for evidence of amnionitis (Blanc 1961).

These tests showed that the infants were exposed to greater risk of infection, but most of those from whom pathogens were grown did not show clinical infection. When infected, infection was present from birth (Wilson 1964). Cord blood cultures are not reliable, due to significant vaginal contamination (Pryles 1963). Only 20% with leucocytic infiltration of umbilical cord develop clinical sepsis (Pryles 1963). Histological amnionitis is not a certain index of intrapartum infection of mother or foetus (Rao 1966).

Prophylactic Antibiotics and other Anti-infective Agents: Penicillin, streptomycin, chloromycetin and tetracycline all cross the placental barrier. The use of chloromycetin and streptomycin has been discontinued, particularly chloromycetin,

because of the toxic effects on the foetus (Kent and Wideman 1959).

Statistical studies with few exceptions (Sangalang 1957, Burchell 1964) have shown the futility of routine prophylactic antibiotics in the latent period (Lebherz 1963, Townsend 1966, Russelll 1962, Eastman 1966,). Broad spectrum antibiotic may even be contraindicated since the balance of vaginal flora may be affected (Flowers 1958). Nitrofurazone vaginal suppositories were tried by Brelje (1966) with no effect. Brown (1939) proposed vaginal infiltration of acriflavine 1% in glycerine in all cases of rupture of membranes every 4 to 6 hours. This is still carried out in some hospitals (Hesseltine 1962).

Antibiotics during labour and puerperium may prevent maternal infection and certainly modify it but have no effect on the foetus (Lebherz 1963, Riviere 1965). A timely culture and sensitivity report on smears taken during the latent period would indicate the antibiotics of choice during labour and puerperium or after the onset of infection (Barbaro 1967).

Antibiotics given as a routine to ininfants delivered after PRM did not appreciably affect perinatal mortality. The futility of laboratory tests in identifying infants likely to develop neonatal infection has been established (Wilson 1964).

Termination of Pregnancy: It is generally agreed that in all pregnancies beyond 37 weeks a decision to deliver should be taken after 12 hours of rupture of membranes with the aim of delivery within 24 hours. If oxytocin is contra-indicated or fails, caesarean section should be done. Oxytocin stimulation is successful 95 times in 100. If 5 in 100 have caesarean section the relative jeopardy is much less than that of maternal and foetal infection if the latent period is prolonged beyond 12-24 hours (Russell 1962).

Indecision, however, exists regarding management of patients before the 36th week, as the risk of prematurity is weighed against the risk of infection. Many authors still claim that the length of time gained in utero far outweighs the risk of maternal and foetal infection (Eastman 1966, Greenhill 1962, Kaplan 1963, Taylor 1961). Gillibrand (1967) justifies waiting before the 34th week, after that extra maturity is seldom gained to justify risk of infection. The chances of continuing pregnancy for 5-30 days after PRM is 6 times higher at 6-7 months than at 9 months of pregnancy (Riviere 1965). If it is hoped to gain more time for the foetus in utero the temptation to make a vaginal examination should be resisted. Since some hold the opinion that infection is unlikely to occur after 72 hours, they consider it relatively safe to send a patient home after the third day to await spontaneous onset of labour. Romney (1966) even suggests that she is safer at home, away from the concentration of pathogens in the hospital environment and the temptation to the obstetrician "to do something". Burchell (1964) found no appreciable difference in perinatal mortality and maternal morbidity whether or not the patient was kept in the hospital or discharged undelivered.

The trend now is more in favour of aggressive management (Russell 1962, Lanier 1965, Webster 1969). Lanier warns against complacency in these cases and states "the favourable outcome after 3 to 4 months of rupture of membranes is the exception and only tends to cloud the picture". Of 26 patients sent home to await maturation of the foetus, 8 returned with amnionitis, 2 developed sepsis and induction of labour to empty the uterus resulted in shock, and there were 4 stillbirths (Russell 1962). Further, in babies weighing 1500-2500 gms., initiation of

3. Demonstration of fat droplets, lanugo hairs and epithelial cells in the vaginal fluid. (Brosens 1965, Averette 1963).

Intrauterine Infection: With PRM the barrier against infection is destroyed and the danger of infection to both mother and infant increases with each 12 hours that elapse between PRM and delivery (Breese 1961, Burchell 1964, Kjessler 1956, Shubeck 1966 and others).

Amnionitis: Sepsis is first manifest as amnionitis "the premature rupture of membranes accompanied by a rise of temperature to 38°C or more before or during labour and escape of malodorous amniotic fluid with no other focus of infection", Russell (1962). When labour does not ensue within 24 hours 50% develop amnionitis and 28.5% post-partum infection (Lanier 1956). However, the mother may appear well when the amniotic fluid, placenta and infant are infected (Wilson 1964).

Neonatal infection of intrauterine origin is difficult to diagnose. The commonest, pneumonia, may be unsuspected until postmortem (Wilson 1964). Pryles (1963) makes a diagnosis of clinical sepsis when the infants "are not doing well". They may have fever or subnormal temperature, anorexia, vomiting, failure to gain weight, apnoea, and cyanosis. Clinical sepsis occurred in 31% of infants born after PRM as against 5% in controls without PRM, but it can be proved bacteriologically in only 5%.

Perinatal Mortality: The perinatal loss in PRM is approximately twice as high as the hospital average (Taylor 1961)). In neonates it escalates with ever 12 hours' increase in the latent period from 12% in 24 hours to 27% in 48 hours and continues to increase at a lesser rate as the latent period lengthens (Webster 1969).

There is a difference of opinion regarding the relative importance of infection and prematurity as a cause of perinatal loss. Wilson *et al* (1964) claimed that the increased neonatal morbidity and mortality are as much related to obstetric complications, prematurity and intrauterine hypoxia, as to infection. They exclude atelectasis from the infection category, while Webster (1969) states that intrautrine pneumonia with consolidation may grossly resemble atelectasis.

In weights below 2500 gms., the greatest single hazard is prematurity and as the prematurity rate is 3 to 4 times the hospital average, the high perinatal loss can be attributed to prematurity rather than to infection (Gillibrand 1967, Taylor 1961 and Lebharz 1961) do not believe that perinatal mortality of mature infants is affected by PRM. On the other hand, Eastman (1966) states that a fourfold increase in perinatal mortality in mature infants, when the latent period exceeds 48 hours, is due to infection; 30.7% of perinatal mortality was due to amnionitis and intrapartum infection (Flowers 1958) and perinatal mortality due to infection rises even when maternal infection is not overt (Russell 1962).

Maternal Mortality: Even more sinister than the reports of infection and perinatal loss are those of maternal death (Webb 1967, Lanier 1965, Webster 1969). Webb draws attention to the increasing proportion of maternal deaths, due to PRM, over a 4 years period, when 54 out of 1054 maternal deaths were due to PRM. No period of pregnancy was spared and there were 10 deaths between 16 and 20 weeks. The majority had no temperature on admission and in 15 cases less than 24 hours had elapsed between PRM or temperature and delivery. The primary cause of death was sepsis with the ever present danger of septic shock.

labour doubled the chances of survival (Russell 1962).

It is generally agreed that when clinical evidence of infection is present, a broad spectrum antibiotic should be given and pregnancy terminated regardless of period of gestation (Hoffmeister 1962). It may, however, be too late to salvage either the mother or the baby. Webster (1969) has shown that after PRM with a long lag period even in the absence of overt symptoms of infection, the infection can suddenly become fulminant and even fatal.

It is conceivable that routine induction at 37 weeks or less could lead to higher perinatal mortality from infection by prolonging the actual contraction time associated with labour (Lebherz 1963). This needs further study.

Premature rupture of membranes is one of the most challenging situations the obstetrician encounters and in this problem above all "in any dynamically oriented concept of obstetric practice, positive thinking should have replaced complacency, skillful neglect and watchful waiting" (Barter).

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