EARLY PREDICTION OF RESPIRATORY DISTRESS SYNDROME AND ITS RELATIONSHIP WITH CERTAIN NEONATAL AND OBSTETRICAL FACTORS BY GASTRIC SHAKE TEST

by

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Introduction

Respiratory distress syndrome presents a major threat to the survival of newborns and contributes inestimably to the mortality in this age group.

Estimation of lecithin/sphingomyelin ratio in amniotic fluid has made, prediction of foetal lung maturity a reality. However, the equipment required are not available universally. The development of shake test for use with amniotic fluid provide expediency, simplicity and economy, but can only be performed in centres where aminocentesis can be done (Clements *et al* 1972). At the same time though the technique of aminocentesis is generally safe, but not without hazards. Recently, shake test has been studied on gastric samples of neonates. The present study has been undertaken to find out the reliability of shake test in anticipating the incidence of respiratory distress syndrome and effect of certain neonatal and obstetrical factors on its development.

Material and Methods

The present study was carried out in 310 neonates, irrespective of their gestational age and birth weight, born between November 1980 and April 1981 at Associated Group of Hospitals attached to Sardar Patel Medical College, Bikaner. The sample also included the babies delivered by caesarean section, breech presentation and also those born to the mothers having diabetes, essential hypertension and eclampsia etc.

The gestational age was estimated by interviewing the mothers for their exact date of last menstrual period. The babies were also subjected to the physial and neurological examination as described by Dubowitz *et al* (1970). The case showing the difference of more than 2 weeks in gestational age by these 2 criteria were excluded from the study. A detailed history of mother with relevant obstetrical problems, nature of delivery, important perinatal events and complete

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examination of newborn was recorded on a pre-determined proforma.

Collection of Gastric aspirate: The gastric aspirate was obtained within half an hour of birth by a polythene catheter before giving anything by mouth to the baby. The samples contaminated with blood, mucus, meconium or slimy flocculent material were discarded.

A single dilution gastric aspirate shake test was performed as described by Transwell (1977). After recording the test result the newborn infant was observed for signs of respiratory distress syndrome. The respiratory distress syndrome was diagnosed according to the criteria described by Baden *et al* (1972) and observations were recorded.

Observations

A single step gastric aspirate test was performed in 310 neonates of which 176 were males and 134 females. Their gestational age varied from 27 weeks to 42 weeks (mean 37.4 weeks) and their weight ranging from less than 1 Kg to more than 3.5 Kg (mean 2.59 Kg).

Table 1 shows relationship of shake test with development of R.D.S. The overall incidence of R.D.S. was 2.58%. None of the neonates with intermediate or positive shake test developed R.D.S. Out of 16 babies showing negative shake test, 8 (50%) developed R.D.S.

Table II reveals the relationship of shake test with gestational age and development of respiratory distress syndrome in neonates. At 27-28 weeks of gestation, 75% of neonates developed R.D.S. and the incidence declined progressively with the advancement in gestational age, while at

TABLE I

Relationship of Shake Test to R.D.S.

Shake test	No. of cases	Percentage	R.D.S.	
			No. of cases	Percentage
Positive	282	90.9	0	0
Intermediate	12	3.9	0	0
Negative	16	5.2	8	50
Total	310	100	8	2.58

TABLE II

Relationship of Shake Test to Gestational Age and R.D.S.

Gestation age in weeks	No. of cases	SHAKE TEST RESULTS						R.D.S.	
		Positive		Intermediate		Negative			
		No. of cases	Percentage	No. of cases	Percentage	No. of cases	Percentage	No. of cases	Percentage
27-28	4	—	—	1	25.0	3	75.0	3	75.0
29-30	3	—	—	1	33.3	2	66.6	2	66.6
31-32	8	2	25.0	2	25.0	4	50.0	1	12.3
33-34	20	13	65.0	4	20.0	3	15.0	1	5.0
35-36	69	65	94.2	4	5.8	2	2.8	1	1.4
37-38	82	80	97.56	—	—	2	2.4	—	—
39-40	106	106	100	—	—	—	—	—	—
41-42	18	18	100	—	—	—	—	—	—

term none of the neonates developed respiratory distress syndrome. It was interesting to note that all the neonates of less than 31 weeks gestation with negative shake test developed R.D.S. In 104 neonates with gestational age less than 37 weeks, 8 (7.69%) developed respiratory distress syndrome.

Table III shows correlation of shake test with birth weight of neonates and development of R.D.S. In neonates weighing less than thousand grams, R.D.S. developed in 60% of cases. The incidence of R.D.S. decreased as the weight of the neonates increased and none of the children weighing more than 2.5 Kg developed

Table IV shows shake test results in neonates born of abnormal pregnancy and their correlation with respiratory status after birth. In 50 neonates delivered of abnormal pregnancy, 2 (4%) developed respirratory distress syndrome.

TABLE III

Relationship of Shake Test with Birth Weight and R.D.S.

Weight in Kg	No. of cases	SHAKE TEST RESULTS						Incidence of R.D.S.	
		Positive		Intermediate		Negative			
		No. of cases	Percentage	No. of cases	Percentage	No. of cases	Percentage	No. of cases	Percentage
Less than 1	5	—	—	—	—	5	100	3	60.0
1.1-1.5	20	6	30.0	8	40.0	6	30.0	2	10.0
1.6-2.0	47	41	87.2	3	6.3	3	6.3	2	4.2
2.1-2.5	72	69	95.81	1	3.38	2	2.7	1	1.3
2.6-3.0	118	118	100	—	—	—	—	—	—
3.1-3.5	38	38	100	—	—	—	—	—	—
3.6 or more	6	6	100	—	—	—	—	—	—

TABLE IV

Relationship of Shake Test in Abnormal Pregnancy

Type of complication	No. of cases	SHAKE TEST RESULTS						Respiratory Distress Syndrome	
		Positive		Intermediate		Negative			
		No. of cases	Percentage	No. of cases	Percentage	No. of cases	Percentage	No. of cases	Percentage
Eclampsia	6	—	—	—	—	6	100.0	—	—
Essential hypertension	3	—	—	—	—	3	100.0	—	—
A.P.H.	6	3	50.0	2	66.6	1	33.3	1	16.67
Breech	6	—	—	—	—	6	100.0	—	—
Rh (Incompatibility)	2	—	—	—	—	2	100.0	—	—
Caesarean	15	1	6.6	—	—	14	92.7	1	6.67
Twins	6	—	—	—	—	6	100.0	—	—
Diabetes	4	—	—	—	—	4	100.0	—	—
Heart diseases	2	—	—	—	—	2	100.0	—	—
Total	50	4	8.0	2	4.0	44	88.0	2	4

TABLE V
Comparative Incidence of R.D.S. in Normal and Abnormal Pregnancy

Gestational age in weeks	Type of pregnancy	R.D.S.	
		No. of cases	Percentage
Before 34 weeks	Normal	5	71.42
	Complicated	1	50.00
	Total No. of cases	6	66.66
After 34 weeks	Normal	1	20.00
	Complicated	1	50.00
	Total No. of cases	2	28.5

Table V shows comparative incidence of respiratory distress syndrome in normal and complicated pregnancy before and after 34 weeks of gestation. On the whole, there was no statistical difference between normal and complicated pregnancy, but the incidence was 2.4 times higher in newborn infants born before 34 weeks of gestation as compared to those born after 34 weeks.

Table VI shows comparison of incidence

TABLE VI
Comparison of R.D.S. in Vaginal and Operative Deliveries

Route of delivery	Total No. of cases	Respiratory Distress Syndrome	
		No. of cases	Percentage
Vaginal	295	7	2.37
Caesarean	15	1	6.6
Total	310	8	2.58

of R.D.S. in vaginal deliveries over operative. Incidence of R.D.S. was 2.78 times higher in operative delivery over vaginal.

Discussion

Respiratory function in newborn depends upon the intrauterine development of the adequate amount of a surface active material 'surfactant' within the lung alveoli (Brumley *et al*, 1967). Sefton (1972) showed that the fluid swallowed immediately before birth may be amniotic fluid containing the surface active material which passes from respiratory tract to the amniotic fluid, explaining the basis of shake test using gastric fluid of neonate. Later it was suggested by Oliver and Strang, in 1974, that the foetal lung fluid is directly swallowed in the stomach without mixing in the amniotic fluid and hence it is more representative sample of lung derived surface active material. Therefore, it was observed by many workers that the shake test using gastric aspirate was more sensitive than did amniotic fluid Lecithin/Sphinomyelin ratio in knowing about the future respiratory course of the infant (Transwell *et al* 1977; Arya and Singh, 1979 and Thomas *et al* 1981).

In the present study it is evident from Table I that none of the neonates with intermediate or positive shake test developed R.D.S., while 50% cases with negative shake test developed it. Overall incidence of R.D.S. was 2.58%. Fisher (1973) and Bhagwanani (1973) also found that the positive shake test reflects absence of R.D.S., whereas negative was

of poor predictive value as false negative result do occur specially below 35 weeks of gestation.

In the present study, a linear correlation was observed between advancing gestational age, birth weight and incidence of positive shake test. It may be because of more production of surfactant especially after 37 weeks of gestation and in neonates weighing more than 2.5 Kg. The risk of respiratory distress syndrome was inversely related to the gestational age and birth weight. Similar observation was made by other workers (Usher *et al* 1971 and Arya and Singh, 1979).

It was observed in the present study that the chances of developing R.D.S. was 2.4 times more in abnormal pregnancy over normal, after 34 weeks of gestation. Gluck *et al* (1973) found higher risk of R.D.S. in cases of complicated pregnancy due to inhibition of surfactant by hypoxia and acidosis. Cohmen *et al* (1960) reported R.D.S. 5.6 times more in pregnancy with placenta previa than those without this complication. Roux *et al* (1973) found that shake test in high-risk pregnancy reliably diagnoses pulmonary maturity only when it is positive and rules out risk of developing R.D.S. Negative and intermediate results are less reliable. Similar observations were made in present study. It was also observed that the risk of R.D.S. was 3 times more in infants delivered by operative methods (Table VI). This observation is in agreement with the observation of Usher *et al* (1971), Lofstrand *et al* (1976) and Risto-Tuimala (1978). Thus we have observed that gastric aspirate shake test is a simple, quick, reliable and inexpensive tool for predicting lung maturity and risk of development of respiratory distress syndrome. The test is ideal for use in delivery units, where neither amniocentesis nor Lecithin/Sphingomyelin ratio is available and where an early transfer of baby to intensive care unit has to be considered.

References

1. Arya, L. S. and Singh, M.: Ind. J. Med. Res. **70:** 444, 1979.
2. Baden, M., Bauer, C. R., Colle, E., Klein, G., Taeusch, H. W. and Stein, L.: Pediatrics, **50:** 526, 1972.
3. Bhagwanani, S C., Flimy, D. and Turnbull, A. C.: Brit. Med. J. **1:** 697, 1973.
4. Brumley, G. W., Hodson, W. A. and Anery, M. E.: Paediatrics, **40:** 13, 1967.
5. Clements, J. A., Platzer, A. C. G., Tierney, D. F., Hobel, C. J., Greasy, R. K. and Margoles, A. J. The: beault, D. W., Tooley, W. H. and Oh, W.: N. Engl. J. Med. **286:** 1077, 1972.
6. Cohmen, M. M., Wintraub, D. H. and Lidinfield, A. M.: Pediatrics, **26:** 42, 1960.
7. Dubowitz, L. M. S., Dubowitz, V. and Goldberg, C.: J. Paed. **77:** 1, 1970.
8. Fisher, P. M. and Southerland, S.: Brit. Med. J. **2:** 423, 1973.
9. Gluck, L., Sribney, M. and Kulovich, M. V. B.: Ped. Clin. North Amer. **20:** 2, 367, 1973.
10. Lofstrand, T., Fex, and Holmberg: Acta Obstet. Gynec. Scand. **55:** 145, 1976.
11. Oliver, R. E. and Strong, L. B.: J. Physiology. **242:** 327, 1974.
12. Risto, Tuimala: Acta Obstet. Gynaec. Scand. (Suppl.) 74), 1978.
13. Roux, J. F., Nakamura, J. and Brown, E.: Am. J. Obstet. Gynec. **117:** 280, 1973.
14. Sefton, S. M., Soontharotoke and Borer, R. C.: Diagnosis of respiratory distress syndrome by the L/S ratio of newborn gastric aspirate presented at a meeting of midwest society for pediatric research Chicago November, 1972 (unpublished): Quoted Reference: Arch. Dis. Child, **52:** 541-544, 1977.

15. Thomas, S., Verma, I. C., Singh, M. and Menon, P. S. M.: Spectrum of respiratory distress syndrome in the newborn in north India. A prospective study. Ind. J. Ped. 48: 61, 1981.
16. Transwell, A. K., Shrewin, E. and Smith, B. T.: Step gastric aspirate shake aspirate test bed predictor of pulmonary morbidity. Arch. Dis. Child, 52: 541, 1977.
17. Usher, R. H., Allen, A. C. and Mclean, F. H.: Am. J. Obstet. Gynec. 111: 826, 1971.