CORRELATION OF BUBBLE STABILITY TEST WITH BIRTH WEIGH AND DUBOWITZ SCORE FOR MATURITY*

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With maturity of the foetus often doub'ful, the need for timely intervention in obstetrics often poses a problem. Clements *et al* (1972) devised the bubble stability test which is based on the presence of the pulmonary surfactant in the amniotic fluid. Dipalmitoyl lecithin is present in the tracheal secretions, which drifts from the fetal lung to the amniotic cavity. The concentration of the surfactant in the amniotic fluid increases after 34 weeks gestation, thereby reflecting the fetal lung maturity. Bubble stability test is a fast clinical test requiring no specialised technology. It serves to predict the chances of respiratory distress syndrome, the aetiology of which is ill understood. In this study bubble stability test is correlated with birth weight and maturity score. The maturity score of Dubowitz *et al* (1970) reflects the total development, in particular development of the central nervous system. It takes into consideration both external and neurological criteria.

Material and Methods

One hundred normal pregnant women admitted in the Department of Obstetrics and Gynaecology, Lady Hardinge Medical College and Hospital were studied. The patients were divided into 2 groups, Control Group consisting of patients in whom the period of gestation was known and study group of 39 patients with unknown gestational period.

The Amniotic fluid was collected by low rupture of membranes, or at the time of caesarean section or by amniocentesis. Bubble Stability Test findings were correlated with birth weight and maturity score of the newborn.

Bubble Stability Test was carried out as described by Clements *et al* (1972). Volumes of amniotic fluid 1.0, 0.75, 0.5, 0.25 and 0.20 ml. were pipetted into tubes labelled 1/1, 1/1.3, 1/2, 1/4 and 1/5 respectively. Volumes of 0.25, 0.50, 0.75 and 0.80 ml. of 0.9% saline were pipetted into tubes numbered 1, 2, 3, 4 and 5 respectively. One ml. of 95% ethanol was added to each tube. The tubes were shaken vigorously for 15 seconds and then placed vertically. Fifteen minutes later the air liquid interface was examined in each tube for the presence of small, stable bubbles. A tube was recorded as positive if it showed a complete ring of bubbles in the meniscus. The test was graded as follows:

Negative—No foam ring in the first tube.

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Intermediate—Complete foam ring in first or first two tubes.

Positive—Complete foam ring in first three or more tubes.

Maturity Scoring: The scoring method used by Dubowitz *et al* (1970) was followed. It is based on 10 neurologic and 11 external criteria, full score being 35 for each. The mean of the 2 scores was taken. This scoring was always done by the first author to avoid any subjective discrepency. The combined external and neurological score is considered more reliable than one alone.

Observations

1. *Maturity score in relation to period of gestion* (Table I):

Dubowitz scoring was done in babies with known gestation period (61 cases). It was found that at or below 34 weeks gestation all 4 (100%) had a maturity score of less than 20. Above 36 weeks of gestation 98.1% (51 cases) of the babies had a maturity score above 25 and above 38 weeks all above 100% (42) had a score 25 (Table II). When the gestational age was above 40 weeks, 93.7% (15) had a maturity score of 30 or above. This data

TABLE I
Dubowitz Scoring

No.	Neurological Criteria	Maximum Score	No.	External Criteria	Maximum Score
1.	Posture	4	1.	Edema	2
2.	Square Window	4	2.	Skin texture	4
3.	Ankle dorsiflexion	4	3.	Skin colour	3
4.	Arm recoil	2	4.	Skin opacity	4
5.	Leg recoil	2	5.	Lanugo	4
6.	Popliteal angle	5	6.	Planter creases	4
7.	Heel to ear	4	7.	Nipple formation	3
8.	Scarf sign	3	8.	Breast size	3
9.	Head lag	3	9.	Ear form	3
10.	Ventral suspension	4	10.	Ear firmness	3
			11.	Genitals	2
	TOTAL	35		TOTAL	35

TABLE I
Comparison of Period of Gestation with Maturity Score in Control Cases

Period of in weeks Gestation	Number	Maturity Score		
		20	20-30	30
34	4	4 (100%)	—	—
35,36	5	3 (60%)	1 (20%)	1 (20%)
37,38	10	1 (10%)	4 (40%)	5 (50%)
39,40	26	—	8 (30.7%)	18 (69.3%)
40	16	—	1 (6.3%)	15 (93.7%)

TABLE II

Period of Gestation in weeks	Number	Maturity Score		
		15	15-25	25
34	4	3 (75%)	1 (25%)	—
35,36	5	1 (20%)	3 (60%)	1 (20%)
37,38	10	—	1 (10%)	9 (90%)
39,40	26	—	—	26 (100%)
40	16	—	—	16 (100%)

obtained from the control cases was used for estimating maturity in the newborns of the study group.

2. *Bubble Stability Test in relation to known period of gestation* (Table III):

None of the cases below 36 weeks of gestation as calculated by Neagle's rule had a 'positive' result, neither there were any 'negative' results after 36 weeks of gestation.. Fig. 1.

A 'positive' result of the test is highly suggestive of a term infant as it was positive in 95.3% (40) of the cases above 38 weeks, the value of 'p' being less than 0.001. Roux *et al* (1973) also found that 'positive' foam was 100% accurate in predicting a mature foetus.

An 'Intermediate' test was observed in premature as well as in near term infants. Roux *et al* (1973) also found that Intermediate' test is not conclusive of maturity.

'Negative' test was obtained in 3 cases with gestation less than 34 weeks, one with 35 to 36 weeks and none beyond 36 weeks gestation.

3. *Bubble Stability Test in correlation with Birth Weight* (Table IV):

Negative Bubble Stability is highly suggestive of birth weight less than 2000 gm and 'positive' result suggestive of birth weight above 2500 gm; as 87.8% (65/74) of the positive results were associated with birth weight of more than 2500 gm and 87.5% (7/8) of 'negative' results were associated with birth weight less than 2000 gm.

'Intermediate' result is not predictive of birth weight. (Fig. 2).

RELATION OF BUBBLE STABILITY TEST TO THE PERIOD OF GESTATION Control Group

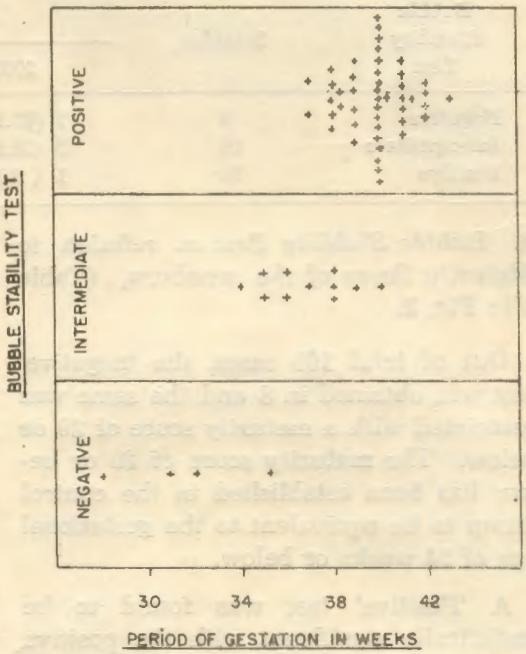

Fig. 1.

TABLE III

Bubble Stability Test in Relation to Period of Gestation

Period of Gestation in weeks	Samples	Bubble Stability Test		
		Negative	Intermediate	Positive
34	4	3 (75%)	1 (25%)	0
35,36	5	1 (20%)	4 (80%)	0
37,38	10	0	4 (40%)	6 (60%)
39,40	27	0	2 (7.4%)	25 (92.6%)
40	15	0	0	15 (100%)

Chi-Square = 60.394; p. .001.

TABLE IV

Bubble Stability Test in Relation to Birth Weight

Bubble Stability Test	Samples	Birth Weight in Grams		
		2000	2000-2500	2500
Negative	8	7 (87.5%)	0	1 (12.5%)
Intermediate	18	7 (38.9%)	7 (38.9%)	4 (22.2%)
Positive	74	1 (1.35%)	8 (10.8%)	65 (87.85%)

4. *Bubble Stability Test in relation to Maturity Score of the newborn,* (Table V): Fig. 3.

Out of total 100 cases, the 'negative' test was obtained in 8 and the same was associated with a maturity score of 20 or below. The maturity score of 20 or below has been established in the control group to be equivalent to the gestational age of 34 weeks or below.

A 'Positive' test was found to be statistically significant with the positive result it was seen that 81.8% (60/74) of the infants had maturity score of 30 or above at birth. Rest all had scores varying between 20 and 30. Maturity score of 30 or more was found at 40 weeks gestation in control group (Table I).

5. *Relation of Bubble Stability Test to the respiratory status of the newborn* (Table VI):

All the newborns in the present study were followed upto the time of discharge from the hospital. Any rise in respiratory rate or recession of the chest cage was recorded as positive respiratory pro-

TABLE V

Bubble Stability Test in Relation to Maturity Score

Bubble stability test	Samples	Maturity Score		
		20	20-30	30
Negative	8	8 (100%)	0	0
Intermediate	18	9 (50%)	7 (38.9%)	2 (11.1%)
Positive	74	0	14 (18.9%)	60 (81.1%)

RELATION OF BUBBLE STABILITY TEST TO THE BIRTH WEIGHT OF BABY.

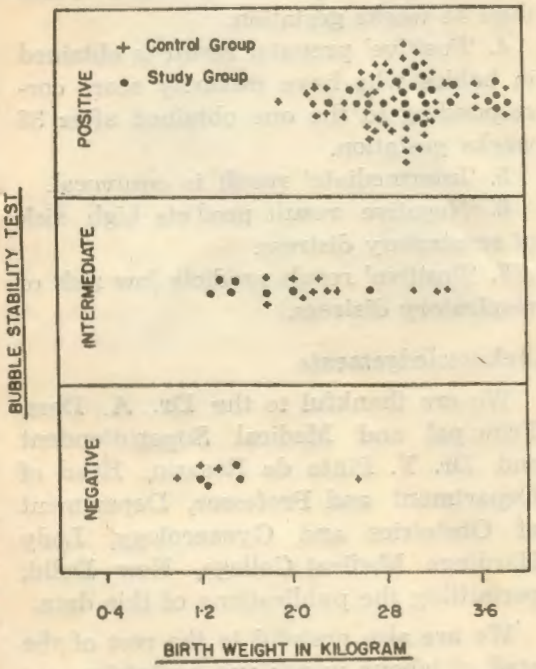

Fig. 2

RELATION OF BUBBLE STABILITY TEST TO THE MATURITY SCORE OF BABY.

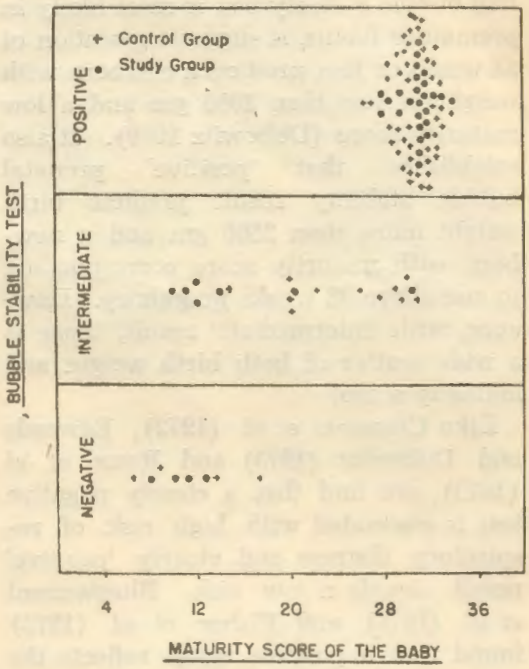

Fig. 3

TABLE VI

Bubble Stability Test Related to the Respiratory Status of Newborn

Bubble Stability Test	Samples	Clinically Respiratory Problem	No Respiratory Problem
Negative	8	7 (87.5%)	1 (12.5%)
Intermediate	18	6 (33.3%)	12 (66.7%)
Positive	74	1 (1.4%)	73 (98.6%)

blem. Out of the 8 patients who had negative results 7 (87.5%) had respiratory problems, 6 of wh'ch expired, 1 left hospital against medical advice and 1 had no problems. Negative result is very suggestive of respiratory distress in the newborn.

Out of 74 cases w:th 'positive' results only 1 baby had subcostal and intercos'al recession on the first day, respiration became normal on second day. Mother of this baby was a known diabetic and also had hydramnios.

Out of the 18 intermediate results, 6

had respiratory problems though none died.

Comments

Present study established that negative bubble stability test is most likely in premature foetus, it suggests gestation of 34 weeks or less, predicts a newborn with weight of less than 2000 gm and a low maturity score (Dubowitz 1970). It also establishes that 'positive' prenatal bubble stability result predicts birth weight more than 2500 gm and a newborn with maturity score corresponding to one above 38 weeks pregnancy. However, with 'intermediate' result, there is a wide scatter of both birth weight and maturity score.

Like Clements *et al* (1972), Edwards and Dubowitz (1973) and Roux *et al* (1973), we find that a clearly negative test is associated with high risk of respiratory distress and clearly 'positive' result signals a low risk. Bhagwanani *et al* (1973) and Fisher *et al* (1973) found that a positive result reflects the absence of risk of respiratory distress, but a negative result was of a poor predictive value and was associated with too many false negatives.

Thus Bubble Stability Test is of value in establishing maturity of the foetus where elective caesarean section is contemplated or termination of pregnancy is considered in mild toxaemia. Its reliability in abnormal pregnancies needs to be established and situations under which false negatives occur need to be elucidated.

Summary

1. 'Positive' bubble stability test predicts a birth weight of 2500 gms or more in 87.85% of cases.

2. 'Negative' results predicts a weight less than 2000 gms in 87.5% of cases.

3. 'Negative' result predicts a Dubowitz maturity score corresponding to that obtained in premature babies of less than 34 weeks gestation.

4. 'Positive' prenatal result is obtained in babies who have maturity score corresponding to the one obtained after 38 weeks gestation.

5. 'Intermediate' result is equivocal.

6. 'Negative result predicts high risk of respiratory distress.

7. 'Positive' result predicts low risk of respiratory distress.

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