

Preterm labour and neonatal parameters

M. BRESADOLA - F. LO MASTRO - V. ARENA - L. BELLAVEGLIA
F. SCARPELLINI

Summary: OBJECTIVES - Our objective was to identify those neonatal factors associated with survival in preterm infants. - MATERIAL AND METHODS - We examined a population of 457 preterm newborns delivered between 1 January - 31 December 1990, with birthweight between < 1000 gr and > 2000 gr, in respect to umbilical pH values, plasmatic glucose values, 5-minute Apgar score and gestational age. Data were abstracted from the maternal intrapartum records and the neonatal records, with specific attention to neonatal parameters.

RESULTS - A positive correlation between birthweight and 5-minute Apgar score, between birthweight, pH and glucose values was noted. No such relationship existed between pH values and 5-minute Apgar score. Within birthweight groups the distribution of neonatal mortality rate was 85.18% in ELBW (Extremely Low Birth Weight) and only 5.26% in LBW (Low Birth Weight).

CONCLUSION - The importance of the ecographic estimate of the fetal weight must be emphasized, since a birthweight of 1500 gr represents the cut-off for the neonatal morbidity and mortality, and also an accurate clinical evaluation of the risk of preterm labour or pathologies in order to improve the estimate of childbirth timing.

Key words: Preterm labour; Neonatal outcome; pH values, plasmatic glucose values.

INTRODUCTION

The survival of premature infants has improved dramatically over the last few years, primarily as a result of the development of intensive neonatal care, especially for those with a gestational age of less than 30 weeks and a low birthweight (LBW).

Received 30-5-1994 from the
2nd Department of Obstetrics and Gynecology
University "La Sapienza", Rome (Italy)

Revised manuscript accepted for publication
8-9-1994.

All rights reserved — No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopy, recording, nor any information storage and retrieval system without written permission from the copyright owner.

The evaluation of the neonatal outcome in preterm labour is, in international literature, based on the correlation between umbilical pH values, plasmatic glucose values dosed within the first hour of life, 5-minute Apgar score, birthweight and gestational age. O.M.S. defines as preterm labour one that occurs before the conclusion of the 37th week of gestation (259 days) ⁽¹⁾. pH and plasmatic glucose values are important indicators of neonatal welfare ^(2, 3). Normal pH values fluctuate between 7.25 and 7.45, values under 7.25 are indicators of neonatal acidosis and asphyxia ^(4, 5, 6). Normal glucose values are included between 25 and 90 mg/ml. We wished through this research to identify those neonatal factors associated with survival preterm infant.

Table 1. — Correlation between 5-minute Apgar score and gestational age.

G.A. Week	24-27	%	28-32	%	33-36	%	Tot.	%
Apgar < 4	7	36.84	7	10.29	8	2.16	22	4.81
Apgar 4-6	8	42.10	15	22.05	21	5.67	44	9.62
Apgar > 7	4	21.06	46	67.66	341	92.17	391	85.57
Total	19	100.00	68	100.00	370	100.00	457	100.00

MATERIALS AND METHODS

The study was carried out in our Department on 457 preterm infants born between January 1 and December 31 1990. All newborns with a gestational age > 24 weeks < 37 weeks and with a birthweight > 700 gr have been considered. The best obstetric estimate of gestational age (including both historic data and ultrasonographic measurements of CRL and/or BPD, before 12th week) was relied on in all cases. Ultrasonographic images were obtained by Ansaldo A U940 ecography. In 1990 the total number of deliveries in both Institutes was of 2296 with a percentage of 14.71% (n = 441) of preterm labour. The total number of newborns was of 3040 of which 15.03% (n = 457) preterm. A division into three groups based on gestational age was made 4.13% (n = 19) between 24 and 27 weeks, 14.08% (n = 68) between 28 and 32 weeks and 81.79% (n = 370) between 33 and 36 weeks.

The characteristics of the newborn were evaluated according to the gestational age, umbilical pH values, glucose values, birthweight and 5-minute Apgar score, considered pathological when less than 4 and between 4 and 6, a good prognostic value when more than 7 (tab. 1). Apgar scores were assigned to all live-born in-

fants by either pediatric staff or labour and delivery nursing staff. Glucose plasmatic values were given by Destrostix within the first hour of life. The newborns were stratified according to birthweight in: Extremely Low Birth Weight (ELBW) with birthweight less than 1000 gr, Very Low Birth Weight (VLBW) between 1000-1500 gr, Low Birth Weight (LBW) between 1500-2000 gr and Appropriate birthweight for Gestational Age (AGA) if higher than 2000 gr. We also evaluated neonatal pathologies, including, in particular Respiratory Distress Syndrome (RDS), Intraventricular Haemorrhage (IVH), Necrotizing enterocolitis (NEC), Disorders of the Nervous System (DNS) and neonatal mortality (NM). The incidence of these pathologies was correlated with birthweight.

RESULTS

Four hundred and fifty seven preterm infants were examined. In Tab. 2 the distribution of 5-minute Apgar score, mean pH and glycemia values within birthweight groups are shown. An analysis of variance demonstrated a significant relationship between birthweight and Apgar score

Table 2. — Distribution of 5-minute Apgar score by birthweight groupings.

Apgar score	ELBW <1000 gr	%	VLBW 1000- 1500 gr	%	LBW 1500- 2000 gr	%	AGA >2000 gr	%
<4	10	37.0	2	4.0	5	8.7	2	0.6
4-6	9	33.3	15	29.4	7	12.3	14	4.3
>7	8	29.7	34	66.6	45	79.0	306	95.1
mean pH	7.21		7.25		7.29		7.30	
mean glycemia	48.12		47.51		52.22		51.91	

Legend — ELBW: Extremely low birth weight; VLBW: Very low birth weight; LBW: Low birth weight; AGA: Appropriate birthweight for gestational age.

Table 3. — Distribution of pH values by birthweight groupings.

pH	ELBW		VLBW		LBW		AGA	
	N.	%	N.	%	N.	%	N.	%
< 7.20	14	51.9	14	27.5	7	12.3	38	11.8
7.20 - 7.25	4	14.8	9	17.6	9	15.8	52	16.2
> 7.25	9	33.3	28	54.9	41	71.9	232	72.0
Total	27	100.0	51	100.0	57	100.0	322	100.0

Table 4. — Distribution of glucose values by birthweight groupings.

Glucose mg/ml	ELBW		VLBW		LBW		AGA	
	N.	%	N.	%	N.	%	N.	%
< 25	4	14.8	16	31.4	8	14.1	32	10.0
25-90	23	85.2	33	64.7	49	85.9	285	88.5
>90	0	0.0	2	3.9	0	0.0	5	1.5
Total	27	100.0	51	100.0	57	100.0	322	100.0

($p < 0.001$). In Tab. 3-4 the distribution of pH values and glycemia among the birthweight groups was evaluated. We considered pH values < 7.20 as indicators of neonatal significant acidosis, between 7.20 and 7.25 as indicators of minor level of acidosis and values > 7.25 as normal, while glucose values < 25 mg/ml suggested significant hypoglycaemia, between 25 and 90 mg/ml normal, > 90 mg/ml significant neonatal hyperglycaemia. These tables show the normalization of the values of pH and glycemia with increase of birthweight. The correlation between neonatal mortality, birthweight and pH is reported in Tab. 5. In Tab. 6 the outcome of 457 preterm newborns, divided in three birthweight groups, is shown. The rate of neonatal mortality in

ELBW was 85.18% ($n = 23$), 7.84% ($n = 4$) in VLBW, 5.26 ($n = 3$) in LBW, only 0.93% ($n = 3$) in the newborns with birthweight > 2000 gr.

The incidence of DNS, RDS and NEC was reduced by 50% in the newborns with a birthweight between 1000-1500 gr (VLBW) in respect to the newborns with birthweight < 1000 gr, while the incidence of IVH is the same. The differences between the VLBW and LBW newborns (1500-2000 gr) were correlated above all with a further decrease of 50% of RDS, IVH, and a relative increase of DNS incidence. Finally, the outcome of newborns with a birthweight > 2000 gr is the same as that of the newborns with a gestational age > 37 weeks.

Table 5. — Distribution of neonatal mortality by pH values in birthweight groupings.

pH	ELBW		VLBW		LBW		AGA	
	N.	%	N.	%	N.	%	N.	%
< 7.20	14	60.8	3	75.0	1	33.3	0	0.0
7.20 - 7.25	3	13.1	1	25.0	0	0.0	0	0.0
> 7.25	6	26.1	0	0.0	2*	66.7	3*	100.0

* Newborns with multiple malformations.

Table 6. — Outcome of 457 newborns divided in four groups based on birthweight.

	IVH	%	DNS	%	RDS	%	NEC	%	NM	%
ELBW	5	18.58	5	18.51	19	74.37	1	3.70	23	85.18
VLBW	8	15.68	5	9.80	21	41.17	1	1.96	4	7.84
LBW	4	7.01	7	12.28	12	21.05	1	1.75	3	5.26
AGA	2	0.62	12	3.72	14	4.34	1	0.31	3	0.93

DISCUSSION

An immediate and overall clinical evaluation of neonatal vitality is effected using a score system as introduced by Virginia Apgar in 1953 (7). An Apgar score less than 7 at 5 minutes may imply the presence of tachypnea, tachy or bradycardia, disorders of the nervous system, for example muscular hyperexcitability or hypotonia, vessel spasm.

These symptoms indicating the lack of neonatal welfare must be correlated with neonatal outcome. No such relationship exists between pH and Apgar score, while a positive correlation between birthweight, Apgar score and clear reduction of pH values correlated with birthweight exists, with mean pH values 7.30 in newborns with birthweight > 2000 gr and mean pH values 7.21 in infants with birthweight < 1000 gr pH value < 7.25 associated with hypercapnia is indicative of neonatal acidosis and asphyxia and in the premature newborns as an indicator of immature lungs. It is interesting to note the pH correlation with prematurity and birthweight too, although this is closely related to gestational age. ELBW newborns presented acidosis and asphyxia. Even the increase of glycemia values in the newborns with an Apgar score less than 6 was correlated an increase of the catabolism of glucose, and thus to a condition of acidosis, due to the increase of catecholamine and to a higher distribution of the reserves of hepatic and tissue glycogen. In this study the close correlation existing between birthweight and neonatal outcome is underlined. In fact in newborns

with an ELBW and VLBW a higher incidence of neonatal pathology and mortality with signs of acidosis and asphyxia at the moment of birth has been observed (8, 9, 10). The reduction of the neonatal pathology and mortality incidence in the LBW is clearly appreciable. The outcome of newborns with a birthweight higher than 2000 gr is similar to that of normal newborns. The importance of the ecographic assessment of the fetal weight must be emphasized (11, 12), since a birthweight of 1500 gr represents the cut-off for the neonatal morbidity and mortality. A close clinical evaluation of births risking preterm labour or pathologies is also important, in order to improve the estimate of childbirth timing. In order to method of delivery Kitchen *et al.* (13) provided just such an analysis in a large cohort of infants delivered between 24-48 weeks, and they concluded that cesarean section offered no significant benefit in either survival of the neonate or reduced risk of handicap. On the contrary we observed that cesarean section was associated with a lower rate of neonatal mortality (5%), while the rate of neonatal mortality in spontaneous delivery was 8.9%.

REFERENCES

- 1) Chamberlain G.: "Preterm labour". *BM*, 1991, 5, 303, 44-48.
- 2) Stark C.F., Gibbs R.S. and Freedman W.L.: "Comparison of umbilical artery pH and 5-minute Apgar score in the low birthweight and very low birthweight infants". *Am. J. Obstet. Gynecol.*, 1990, 163, 818-23.
- 3) Goldemberg R.L., Huddleston J.F., Nelson K.G.: "Apgar scores and umbilical arterial

- pH in preterm newborn infants". *Am. J. Obstet. Gynecol.*, 1984, 149, 651.
- 4) Nickolaides K.H., Economides D.L., Soothill P.W.: "Blood gases, pH and lactate in appropriate and small for gestational age fetuses". *Am. J. Obstet. Gynecol.*, 1989, 161, 996.
 - 5) Myles T.D., Strassner H.T.: "Four-quadrant assessment of amniotic fluid volume: distribution's role in predicting fetal outcome". *Obstet. Gynecol.*, 1992, 80 (5), 769-74.
 - 6) Sykes G.S., Johnson P., Ashworth F. *et al.*: "Do Apgar scores indicate asphyxia". *Lancet*, 1982, 1, 494.
 - 7) Pescetto G., De Cecco L., Pecorari D., Ragni N.: "Manuale di ginecologia e ostetricia". *Società Editrice Universo*, Roma 1989, 2, 1094-96.
 - 8) Bottino, De Micheli, Roncaglia, Zanini: "Parto prematuro e mortalità perinatale: 1982-88, parte I". *Ann. Ost. Gin. Med. Perin.*, 1991, 83-90.
 - 9) Svenningsen N.W., Stjernqvist K., Stave-
now S., Stromclestas H.L.: "Neonatal outcome of extremely low birthweight liveborn infants below 901 gr in a Swedish population". *Acta Paediatr. Scand.*, 1989, 78, 180.
 - 10) Apiward G.P. *et al.*: "Outcome studies of low birthweight infants published in the last decade. A metanalysis". *J. Paediatr.*, 1989, 115, 515-20.
 - 11) James D.K., Parker M.J., Smoleniec J.S.: "Comprehensive fetal assessment with three ultrasonographic characteristics". *Am. J. Obstet. Gynecol.*, 1992, 166, 1486-95.
 - 12) Tamura R.K., Sabbagha R.E., Davis C.L. *et al.*: "Antenatal estimates of gestational age and fetal weight as predictors of perinatal mortality in the very preterm fetuses". *J. Matern. Fetal Invest.*, 1991, 1, 261-5.
 - 13) Kitchen W., Ford G.W., Doyle L.W. *et al.*: "Caesarean section or vaginal delivery at 24 to 48 weeks' gestation: comparison of survival and neonatal and two-year morbidity". *Obstet. Gynecol.*, 1985, 66, 149-57.

Address reprints requests to:
F. LO MASTRO
Via R. Filamondo, 10
00135 Roma