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Original Research Article

Changes in the physiological parameters of newborns in the first one hour of life

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ABSTRACT

Background: The transition from a fetus to a newborn is the most complex adaptation that occurs in human experience. This study assessed three physiological parameters viz. temperature (core and peripheral), oxygen saturation and heart rate so as to avoid the delay in normal transitional adaptation.
Methods: This cross-sectional observational study was done at Narayana Medical College Hospital, Nellore, Andhra Pradesh, India. A total of 150 neonates born from June 2017 to February 2018 were monitored for heart rate, oxygen saturation, core and peripheral temperature from birth to 60 minutes.
Results: Most of the mother's (45.33%) were aged between 22 to 25 years and the mean age was 23.75±3.64 years. History of consanguineous marriage was noted in 33.33%. The mode of delivery was vaginal in 70.67% of the babies. The mean gestational age was 38.74±1.36 weeks. The birth weight among 62% of the babies was between 2.5 to 3.49 Kgs and mean birth weight was 2.81±0.49 kgs. The meconium stained liquor and requirement of resuscitation was noted in 9.33% and 10.67% respectively.
Conclusions: Significant difference was noted with regard to heart rate in babies with active resuscitation, low birth weight (<2.5 kg), meconium stained liquor and warmer care compared to normal babies. There was variation in oxygen saturation in babies who required resuscitation and warmer care, and those who had low birth weight. The mean peripheral and core temperature were different in babies with abdominal care compared to warmer care.

Keywords: Heart rate, Meconium stain, Low birth weight, Temperature

INTRODUCTION

Neonatal deaths account for a major proportion of the world's paediatric deaths. Global neonatal mortality declined from 32 deaths per 1,000 live births in 1990 to 23 in 2010, an average of 1.7 percent a year, much slower than the fall in the under-five mortality rate of 2.2 percent per year.[1,2]

Consequently, the proportion of deaths in the neonatal period rose from 38% (4 million) of total deaths in 2000 to about 41% (3.3 million) in 2009.[2] The relatively larger decline in the post-neonatal period compared to the neonatal period may be attributable to the relatively high emphasis and global support for Primary Health Care workforce development and programs such as nutrition, vaccination and health promotion, relative to hospital-related workforce and infrastructure investments that are necessary for neonatal mortality reduction, particularly in rural areas.[3] Neonatal deaths are mainly caused by pre-term birth, asphyxia, sepsis, pneumonia, congenital anomalies and diarrheal diseases.

At birth, newborns enter a foreign environment that lacks the close containment of extremities and continuous nourishment available in the womb. For 9 months of pregnancy, mother and fetus have been one entity. In the womb baby is warm, fed and protected, and that is all it needs to develop.

Postnatal transition from fetus to neonate is characterized by discontinuity. Inevitably the neonate must change environment from the dark, warm, wet, sheltered place in the womb to the colder, dry, bright, loud conditions of the world; the umbilical cord is severed. Separation and rupture are the watchwords. Well-known changes require thermal, cardiovascular, pulmonary, vestibular, immune and metabolic adaptation.[4]

The transition from a fetus to a newborn is the most complex adaptation that occurs in human experience. Lung adaptation requires the coordinated clearance of fetal lung fluid, surfactant secretion, and the onset of consistent breathing. With the removal of the low-pressure placenta, the cardiovascular response requires striking changes in blood flow, pressures and pulmonary vasodilation. The newborn must also quickly control its energy metabolism and thermoregulation. The primary mediators that both prepare the fetus for birth and support the multi-organ transition are cortisol and catecholamine. Prior to medicalization of delivery, the transition had to occur quickly for survival of the newborn. All organ systems are involved at some level, but the major immediate adaptations are the establishment of air breathing concurrently with changes in pressures and flows within the cardiovascular system. Other essential adaptations are striking changes in endocrine function, substrate metabolism, and thermogenesis.[5]

The difficulties for transition for many fetuses include the frequent use of cesarean sections, deliveries prior to the onset of labor, rapid clamping of the cord, and the anesthetics and analgesics associated with these hospital deliveries. The net result is the frequent need to assist the newborn with the birth transition. Preterm deliveries cause particular difficulties for transition and expose the preterm infant to lung injury from mechanical ventilation.

Newborns face major tasks during the 6-hour transitional period after birth. These tasks include conservation of energy, adaptation to the extrauterine environment and recovery from birth related fatigue. Successful completion of each task is reflected in minimal activity and stable physiologic measurements that are within the optimal range.[6]

Maintaining a neutral thermal environment is one of the key physiologic challenges a newborn infant face after delivery. There are four basic mechanisms through which heat is transferred from the newborn to the environment. These include radiation, conduction, convection and evaporation. All may potentially contribute to an unstable thermal environment for the newborn. Heat loss through radiation is related to the temperature of the surfaces surrounding the infant but not in direct contact with the infant. The newborn infant emits heat energy in the form of infrared electromagnetic waves. The loss or gain of this ‘radiant’ energy is proportional to the temperature difference between the skin and the radiating body; heat may be lost from the infant's body to a nearby cold wall or window. Heat may be gained from a source of radiant energy, such as a heat lamp placed near the infant. Heat loss from radiation may be the most important route of heat transfer in infants older than 28 weeks gestational age. Heat loss or gain via conduction occurs through direct contact with a surface with a different temperature. Direct transfer of heat occurs from the newborn to this surface. Heat can be lost directly to a colder surface or gained from a warmer surface, such as a warming mattress. Heat is transferred by convection when air currents carry heat away from the body surface.

If the infants body surface is warmer than the surrounding air (as is almost always the case in the delivery room), heat is first conducted into the air and then carried away by the convective air currents. Last, heat may be lost by evaporation. Evaporation occurs when water is lost from the skin. During evaporation, water is converted from a liquid to a gas, causing approximately 0.6 kcal of heat to be lost for every 1 g of water lost from the body. In the extremely low birth weight (ELBW) infant, evaporative heat loss is the major form of heat loss during the first week of life. This is particularly problematic for infants of the lower gestational age. Transepidermal water loss in infants is inversely correlated with gestational age; infants born at 25 weeks gestation age lose 15 times more water than term infants due to immature and thinner skin.[7]

Infants exposed to cold temperatures are at risk for increased mortality. The normal temperature range for a neonate is 36.5 to 37.7°C. Cold stress may occur when an infant's temperature drops to 36.0°C. Temperatures below 36ºC are considered hypothermic. Moderate hypothermia is considered to be between 32 and 36°C. Severe hypothermia is considered when the infant's temperature is less 32ºC.[7] Hypothermia results in a variety of physiologic stresses. The infant has increased oxygen consumption, metabolic acidosis, hypoglycemia, decreased cardiac output and increased peripheral vascular resistance. Despite efforts to prevent heat loss, ELBW infants continue to exhibit cold body temperatures after delivery room stabilization and throughout the first hours of life. Over two-thirds of ELBW infants are admitted to neonatal intensive care units (NICUs) with temperatures that would be consideredhypothermic.[8]

Similarly, heart rate has a significant potential in evaluating the role of autonomic nervous system fluctuations in normal subjects and in patients with disorders characterized by autonomic dysfunction. It can also aid in better understanding of disease mechanisms and in the study of the action of certain drugs. Vagal tone measurements in newborns and infants have been used to predict behavioral and psychological development and information processing. These indexes may provide a marker for determining the likely outcome of fetal and neonatal disorders on behavior and development. Decreased heart rate indicates a disturbance of autonomic function or decreased ability of the sinus node to respond to extrinsic signals. It may be a marker of "poor health," as seen in many conditions, e.g., diabetes with poor metabolic control, congestive heart failure, and major depression. In contrast, "healthy" habits like physical training increase HRV, primarily through increased vagal tone.[9] Developing nations contribute to the majority of the neonatal mortality and morbidity due to perinatal asphyxia. Yet, most of the delivery rooms and resuscitation corners in these countries are not equipped with air-oxygen blenders and pulse oximeters. It would be a mammoth, long drawn and expensive task to ensure availability of air-oxygen blenders and motion-resistant low perfusion latest generation pulse oximeters in all delivery areas. There is an urgent need to develop consensus guidelines for our own country keeping in mind the ground realities, and also to produce low cost blenders and pulse oximeters.[10,11]

The objective of the study was to record the changes in the physiological parameters in newborns that is, heart rate saturation, core and peripheral temperature immediately after birth for first one hour, to recognize delay in normal transitional adaptation in newborn.

METHODS

This study was done from June 2017 to February 2018 at the Department of Paediatrics, Narayana Medical College Hospital, Nellore, Andhra Pradesh, India.

The study design was a cross sectional observational study. This study was carried out from June 2017 to February 2018. This study was conducted under the Department of Paediatrics, Narayana Medical College Hospital, Nellore, Andhra Pradesh, India a tertiary care teaching hospital.

Source of data

Infants delivered under hospital labour room of Department of Paediatrics, Narayana Medical College Hospital, Nellore, Andhra Pradesh, India were enrolled in this study.

Sample size

A total of 150 newborn babies were studied.

Inclusion Criteria

Infants delivered in Labour room of Department of OBGY, Narayana hospital.

Exclusion criteria

Babies requiring active resuscitation (Bag and mask ventilation). Very low birth weight babies with expected fetal weight of <1500 gms. Babies with congenital anomalies.

Method of collection of data

The parents/caregivers of the newborn were interviewed and information regarding maternal age, history, antenatal care, obstetric index, LMP, EDD, gestational age by last scan, haemoglobin levels, history of medication, pregnancy induced hypertension and gestational diabetes were obtained.

Further delivery information including mode of delivery, birth weight, liquor, cry at birth, resuscitation, apgar score were noted. The neonates were subjected to clinical examination and physical maturity for the assessment of gestational age based on Ballard scoring. Further systemic examination was done, and findings were noted.

Recording of physiological parameters

The monitoring for physiological parameters was done using Pulse oximeter. Neonates were monitored for heart rate, oxygen saturation, core temperature and peripheral temperature. The resuscitation team consisted of four members.

An obstretitian,a pediatrician and two helpers. The obstretitian cleaned the abdomen with betadine to receive the baby on mothers abdomen in case of vaginal delivery. Babies born out of LSCS were resuscitated on warmer. One helper would clean and dry the baby,while the other helper would place the cap on babies head. Meanwhile the pediatrician attached the probes to the baby.

Babies born out of vaginal route were dried and immediately put on the mother's abdomen. The saturation probe was attached to the right hand of the baby with tissue plaster to obtain the preductal values. Two temperature probes, one attached to the sole of right foot and the other to the abdomen just below the sternum for measuring the peripheral and core temperature respectively.

The waveform and signal intensity was noted. Only after getting a regular waveform pattern on the monitor,the values of saturation and heart rate were recorded. The readings were obtained every 5 seconds which were averaged for 1 minute from birth till 60 minutes of life. Babies born out of LSCS were taken on to the warmer, dried and the same procedure was followed as above.

Outcome variables: The neonates were evaluated for the following study variables; Heart rate, Oxygen saturation, Core temperature, and Peripheral temperature.

Data analysis

The data obtained was coded and entered into SPSS version 20. The categorical data was expressed as rates, ratios and proportions and continuous data was expressed as mean±standard deviation (SD). The data was analyzed using independent sample 't' test. A probability value (p) of ≤0.050 was considered as statistically significant.

RESULTS

In the present study most of the mothers were aged between 22 to 25 years (45.33%). The mean age was 23.75±3.64 years with range 18 being minimum and 38 being maximum (Table 1).

Table 1: Maternal age.

Age group	Number	Percentage
18 to 21	43	28.67
22 to 25	68	45.33
26 to 29	27	18.00
30 to 33	9	6.00
34 to 38	3	2.00
Total	150	100.00

In this study, the history of consanguineous marriage was noted among the 33.33% of the parents. Majority (88.67%) of the babies had gestational age between 37 to 40 weeks and the mean gestational age was 38.74±1.36 weeks. In this study history of pregnancy induced hypertension was noted in 4.67% of the mothers. In the present study history of gestational diabetes mellitus was present in 2% of the mothers. In this study 51.33% of the babies were males and 48.67% were females. The male to female ratio was 1.05:1. In the present study 62% of the babies weighed between 2.5 to 3.49 Kgs.

Table 2: Apgar score.

Interval	Apgar score	Number	%
At 1 minute	<7	3	2.00
	7 or more	147	98.00
	Total	150	100.00
At 5 minutes	<7	0	0.00
	7 or more	150	100.00
	Total	150	100.00

The mean birth weight was 2.81±0.49 Kgs with range being 1.70 Kg as minimum and 2.80 Kg as maximum. In this study mode of deliver was vaginal in 70.67% of the babies while 29.33% had LSCS delivery. 9.33% of the babies had meconium stained liquor. resuscitation was noted in 10.67% of the babies. In the present study 70.67% of the newborns had abdominal type of care and 28% were on warmer. 4.67% of the babies required clearing of airway. Stimulation was noted among 6% of the neonates. All the babies had Apgar score of more than 10 at five minutes (Table 2).

Table 3: Mean heart rate from 1 minute to 60 minutes. Heart rate (per minute).

	Mean		Median		
Interval (minutes)	Mean	SD	Median	Minimum	Maximum
1	164.90	17.05	168.00	95.00	180.00
2	167.00	10.36	168.00	118.00	176.00
3	167.90	7.35	168.00	122.00	177.00
4	168.05	5.16	168.00	136.00	176.00
5	167.77	4.31	168.00	158.00	176.00
6	167.41	4.37	167.00	156.00	176.00
7	166.53	4.37	166.00	156.00	176.00
8	165.93	4.33	165.00	154.00	176.00
9	165.56	4.46	165.00	154.00	176.00
10	164.74	4.52	165.00	150.00	175.00
15	161.72	5.20	161.50	148.00	172.00
20	158.63	5.54	159.00	145.00	170.00
25	155.14	6.16	155.00	139.00	167.00
30	152.53	6.48	152.00	139.00	167.00
35	149.47	6.52	149.00	136.00	172.00
40	146.34	6.31	146.00	135.00	170.00
45	143.72	6.19	143.00	131.00	165.00
50	141.67	5.51	140.50	135.00	162.00
55	140.47	5.45	139.50	132.00	160.00
60	140.91	9.98	138.00	131.00	238.00

The mean and median heart rate readings from 1 minute to 60 minutes are as depicted in Table 3. It was observed that, the mean heart rate was high at fourth minutes while low at 60 minutes (Table 3).

Maximum mean oxygen saturation values were noted at 20 minutes and 60 minutes intervals while lower value was noted at first minute of life (Table 4).

Table 4: Mean SPO2 from 1 minute to 60 minutes.

SPO2 (%)					
Interval (Minutes)	**Mean**		**Median**		
	Mean	**SD**	**Median**	**Minimum**	**Maximum**
1	75.45	3.76	75.00	68.00	83.00
2	75.92	4.06	76.00	68.00	86.00
3	76.79	4.53	76.00	69.00	90.00
4	77.79	4.93	77.00	69.00	90.00
5	78.54	5.25	77.00	69.00	91.00
6	79.44	5.75	78.00	70.00	93.00
7	80.45	5.95	79.00	70.00	93.00
8	81.27	6.07	80.00	71.00	93.00
9	81.77	6.08	80.00	71.00	94.00
10	82.29	6.09	80.00	71.00	94.00
15	90.79	3.78	90.50	82.00	98.00
20	93.69	2.26	94.00	87.00	99.00
25	88.86	4.40	89.00	76.00	100.00
30	89.99	4.09	90.00	78.00	98.00
35	90.79	3.78	90.50	82.00	98.00
40	91.52	3.36	91.00	81.00	98.00
45	92.31	3.05	92.00	84.00	100.00
50	92.69	2.81	93.00	85.00	98.00
55	93.13	2.59	93.00	84.00	98.00
60	93.69	2.26	94.00	87.00	99.00

Table 5: Mean peripheral temperature from 1 minute to 60 minutes.

Peripheral temperature (0°)					
Interval (Minutes)	**Mean**			**Median**	
	Mean	**SD**	**Median**	**Minimum**	**Maximum**
1	31.50	0.12	31.50	31.20	31.96
2	31.53	0.11	31.50	31.20	31.80
3	31.56	0.12	31.60	31.05	31.80
4	31.40	2.28	31.60	3.70	31.80
5	31.60	0.14	31.60	31.06	31.90
6	31.64	0.13	31.60	31.20	32.00
7	31.67	0.13	31.70	31.20	31.90
8	31.70	0.14	31.70	31.20	32.00
9	31.74	0.15	31.80	31.20	32.00
10	31.77	0.15	31.80	31.30	32.10
15	32.15	0.22	32.20	31.60	32.90
20	32.41	0.20	32.40	31.80	32.80
25	32.02	0.19	32.00	31.50	32.60
30	32.08	0.21	32.10	31.50	32.80
35	32.15	0.22	32.20	31.60	32.90
40	32.19	0.22	32.20	31.50	32.70
45	32.26	0.22	32.30	31.60	32.80
50	32.30	0.25	32.30	31.20	32.70
55	32.36	0.21	32.40	31.70	32.80
60	32.41	0.20	32.40	31.80	32.80

The mean and median core temperature from 1 minute to 60 minutes are as depicted in table 5. The mean core temperature was low at first minutes and higher at 60 minutes.

Table 5 shows mean and median peripheral temperature from 1 minute to 60 minutes. The mean core temperature was minimum at one minute and maximum at 60 minutes intervals.

Table 6: Comparison of mean heart rate in babies with and without resuscitation.

Resuscitation					
Interval (Minutes)	Required (n=16)		Not required (n=134)		p value
	Mean	SD	Mean	SD	
1	169.32	4.01	127.88	33.29	<0.001
2	169.27	3.77	148.00	22.57	0.002
3	168.99	3.82	158.81	17.58	0.035
4	168.31	4.08	165.88	10.58	0.375
5	167.76	4.05	167.81	6.26	0.975
6	167.38	4.13	167.69	6.19	0.849
7	166.39	4.23	167.69	5.46	0.371
8	165.78	4.14	167.19	5.67	0.350
9	165.40	4.27	166.88	5.86	0.344
10	164.57	4.42	166.13	5.23	0.270
15	161.39	5.04	164.50	5.84	0.056
20	158.25	5.34	161.81	6.32	0.044
25	154.61	5.89	159.56	6.73	0.012
30	151.97	5.98	157.25	8.57	0.028
35	148.78	5.80	155.25	9.16	0.014
40	145.69	5.65	151.75	8.84	0.016
45	142.96	5.48	150.13	8.07	0.003
50	140.96	4.72	147.56	7.91	0.005
55	139.72	4.66	146.75	7.45	0.002
60	140.26	10.05	146.38	7.66	0.008

Table 7: Comparison of mean heart rate in babies with normal and low birth weight.

	Birth weight (kgs)				
Interval (Minutes)	>2.5 (n=110)		<2.5 (n=40)		P value
	Mean	SD	Mean	SD	
1	163.76	17.81	168.03	14.52	0.139
2	165.88	11.20	170.08	6.81	0.007
3	166.84	7.98	170.83	4.09	<0.001
4	167.22	5.33	170.35	3.88	<0.001
5	167.07	4.31	169.68	3.71	<0.001
6	166.76	4.54	169.20	3.32	0.001
7	165.84	4.43	168.43	3.63	<0.001
8	165.28	4.47	167.73	3.34	0.001
9	164.85	4.66	167.53	3.19	<0.001
10	163.97	4.70	166.85	3.21	<0.001
15	160.77	5.37	164.33	3.63	<0.001
20	157.71	5.89	161.15	3.37	<0.001
25	154.23	6.54	157.65	4.05	<0.001
30	151.85	7.00	154.43	4.31	0.008
35	149.01	7.09	150.75	4.44	0.077
40	145.98	6.85	147.33	4.44	0.164
45	143.32	6.81	144.83	3.86	0.093
50	141.31	5.87	142.65	4.28	0.130
55	140.18	5.78	141.28	4.40	0.221
60	140.76	11.30	141.33	4.87	0.672

Table 6 shows the comparison of mean heart in babies with and without resuscitation. Among the babies who required resuscitation, the mean heart rate was significantly high (p <0.050) at one minute which increased till three minutes interval and was comparable with those babies who did not required resuscitation (p >0.050).

The mean heart rate in babies with low and normal birth weight was comparable at one minute interval (p>0.050). Further it was significantly high till 30 minutes interval (p<0.050) and was comparable in the next subsequent intervals (p>0.050) (Table 7).

In the present study the mean heart rate in babies with meconium stained liquor was found to be low at one minute interval (p>0.050) and reached peak at fourth minute and remained high compared to babies with clear meconium. However, the mean heart rate was significantly high from sixth minute onwards to 40 minutes interval (p<0.050) in babies with meconium stained liquor.

In the present study among the babies with warmer care, the mean heart rate at beginning was significantly low (p<0.050) which increased at fourth minute of life and remained high till 60 minutes. Statistically significant difference was noted in the mean heart rate from eighth minute interval to 60 minutes interval (p<0.050) (Table 8). In this study the oxygen saturation was significantly high in babies who required resuscitation at one to three minutes (p<0.050). Further though oxygen saturation was high in these babies it was not statistically significant upto 15 minutes interval (p>0.050) while significantly higher mean oxygen saturation were noted from 20 minutes interval to 60 minutes.

In the present study in babies with birth weight < 2.5 Kgs. oxygen saturation low throughout all the durations. However, the mean oxygen saturation was significantly low from beginning to 15 minutes only (p<0.050) (Table 9).

In this study the mean oxygen saturation in neonates with clear liquor was slight high compared to babies with meconium stained liquor. However, the difference was statistically not significant (p >0.050). It was observed that, neonates on warmer had lower mean oxygen saturation throughout the monitoring period compared to neonates who were on abdomen care. However, this difference was statistically not significant at 3, 7, 9, 10- and 15-minutes interval (p>0.050).

Table 8: Comparison of mean heart rate and type of care.

Resuscitation					
Interval (Minutes)	**Abdominal (N=16)**		**Warmer (N=48)**		**P value**
	Mean	**SD**	**Mean**	**SD**	
1	168.92	8.14	155.23	26.65	0.002
2	169.00	5.88	162.18	15.94	0.008
3	168.59	5.98	166.23	9.79	0.141
4	167.86	5.23	168.52	5.04	0.469
5	167.52	4.22	168.36	4.51	0.291
6	167.12	4.24	168.11	4.65	0.227
7	166.11	4.43	167.52	4.09	0.064
8	165.43	4.51	167.14	3.61	0.017
9	164.90	4.56	167.16	3.83	0.002
10	163.99	4.78	166.55	3.22	<0.001
15	160.76	5.33	164.02	4.07	<0.001
20	157.43	5.64	161.50	4.10	<0.001
25	153.52	5.86	159.05	5.05	<0.001
30	150.87	5.89	156.55	6.13	<0.001
35	147.68	5.34	153.80	7.12	<0.001
40	144.31	4.82	151.23	6.84	<0.001
45	141.49	4.69	149.09	6.10	<0.001
50	139.47	3.81	146.95	5.41	<0.001
55	138.08	3.54	146.23	4.94	<0.001
60	138.80	10.76	146.00	5.01	<0.001

Table 9: Comparison of mean SPO2 in babies with normal and low birth weight.

Interval (Minutes)	Birth weight (kgs)				
	>2.5 (n=110)		<2.5 (n=40)		p value
	Mean	SD	Mean	SD	
1	75.84	3.72	74.38	3.70	0.036
2	76.31	4.14	74.85	3.68	0.041
3	77.23	4.65	75.58	3.97	0.034
4	78.34	5.02	76.30	4.41	0.018
5	79.08	5.29	77.05	4.90	0.031
6	80.13	5.79	77.55	5.26	0.012
7	81.14	5.94	78.55	5.64	0.017
8	81.83	6.12	79.73	5.73	0.055
9	82.39	6.13	80.05	5.66	0.032
10	82.88	6.13	80.68	5.74	0.044
15	85.55	5.27	83.45	5.28	0.034
20	87.53	4.80	85.73	5.02	0.053
25	89.27	4.21	87.73	4.76	0.074
30	90.26	3.99	89.23	4.29	0.186
35	91.07	3.71	90.03	3.89	0.145
40	91.75	3.41	90.88	3.16	0.145
45	92.55	3.11	91.65	2.78	0.092
50	92.91	2.89	92.10	2.50	0.097
55	93.30	2.63	92.65	2.42	0.160
60	93.81	2.32	93.35	2.08	0.251

Table 10: Comparison of mean core temperature in babies with normal and low birth weight.

Birth weight (kgs)					
Interval (Minutes)	>2.5 (n=110)		<2.5 (n=40)		p value
	Mean	SD	Mean	SD	
1	33.53	0.11	33.57	0.14	0.141
2	33.58	0.15	33.62	0.13	0.117
3	33.60	0.16	33.64	0.13	0.158
4	33.64	0.16	33.68	0.13	0.118
5	33.68	0.16	33.73	0.13	0.052
6	33.72	0.18	33.77	0.13	0.065
7	33.76	0.17	33.81	0.12	0.029
8	33.79	0.17	33.86	0.13	0.013
9	33.84	0.19	33.89	0.15	0.088
10	33.87	0.19	33.17	4.78	0.363
15	34.07	0.28	34.10	0.27	0.679
20	34.28	0.35	34.33	0.31	0.387
25	34.53	0.41	34.59	0.38	0.442
30	34.77	0.42	34.87	0.41	0.208
35	35.04	0.45	35.11	0.47	0.409
40	35.31	0.42	35.43	0.44	0.156
45	35.58	0.39	35.68	0.42	0.214
50	35.81	0.34	35.91	0.35	0.143
55	35.99	0.28	36.08	0.31	0.103
60	36.12	0.25	36.24	0.24	0.009

Table 11: Comparison of mean core temperature and type of care.

Resuscitation Interval (Minutes)	Abdominal (n=106)		Warmer (n=48)		p value
	Mean	SD	Mean	SD	
1	33.56	0.13	33.50	0.08	0.003
2	33.61	0.16	33.53	0.08	<0.001
3	33.64	0.17	33.55	0.08	<0.001
4	33.68	0.17	33.58	0.10	<0.001
5	33.72	0.16	33.62	0.12	<0.001
6	33.77	0.16	33.64	0.13	<0.001
7	33.81	0.15	33.67	0.13	<0.001
8	33.86	0.16	33.69	0.12	<0.001
9	33.89	0.18	33.75	0.13	<0.001
10	33.64	0.36	33.78	0.14	0.003
15	34.16	0.27	33.89	0.20	<0.001
20	34.41	0.29	34.01	0.26	<0.001
25	34.68	0.36	34.23	0.29	<0.001
30	34.93	0.38	34.47	0.31	<0.001
35	35.21	0.39	34.70	0.38	<0.001
40	35.48	0.38	35.00	0.35	<0.001
45	35.74	0.35	35.30	0.34	<0.001
50	35.94	0.29	35.58	0.32	<0.001
55	36.10	0.25	35.80	0.25	<0.001
60	36.24	0.20	35.94	0.23	<0.001

Table 12: Comparison of mean peripheral temperature and type of care.

Resuscitation Interval (Minutes)	Abdominal (n=106)		Warmer (n=48)		p value
	Mean	SD	Mean	SD	
1	31.51	0.12	31.47	0.11	0.052
2	31.55	0.11	31.50	0.10	0.009
3	31.57	0.13	31.52	0.09	0.010
4	31.34	2.71	31.55	0.10	0.414
5	31.62	0.14	31.55	0.12	0.002
6	31.66	0.13	31.59	0.11	0.001
7	31.69	0.12	31.63	0.13	0.007
8	31.73	0.13	31.64	0.16	0.001
9	31.77	0.13	31.68	0.18	0.006
10	31.79	0.14	31.71	0.17	0.004
15	31.87	0.13	31.81	0.17	0.051
20	31.97	0.16	31.90	0.18	0.039
25	32.04	0.16	31.95	0.22	0.012
30	32.10	0.20	32.02	0.24	0.060
35	32.18	0.20	32.06	0.24	0.004
40	32.22	0.19	32.11	0.26	0.015
45	32.30	0.18	32.16	0.27	0.002
50	32.34	0.23	32.20	0.27	0.003
55	32.41	0.18	32.25	0.23	<0.001
60	32.46	0.18	32.30	0.22	<0.001

The mean core temperature among the neonates with birth weight of <2.5 Kg and normal birth weight was comparable at all the durations except at 7, 8 and 60 minutes (Table 10).

Throughout all the intervals the mean core temperature was significantly high in babies who were on abdominal care (p<0.050) (Table 11). The mean peripheral temperature in neonates with birth weight of <2.5 Kg and normal birth weight was comparable at all the durations (p>0.050).

Throughout all the intervals the mean peripheral temperature was significantly high in babies who were on abdominal care(p<0.050) (Table 12).

DISCUSSION

Most of the babies (62%) weighed between 2.5 to 3.49 Kgs and the mean birth weight was found to be 2.81± 0.49 Kgs. The meconium stained liquor was noted in 9.33% of the babies and requirement of resuscitation was noted among 10.67% of the newborns. Majority had abdominal care (70.67%) while airway clearing, and stimulation was indicated in 4.67% and 6% of the babies respectively.

In this study, the mean heart in babies who required resuscitation was significantly high (p<0.050) at one to three minutes compared to those babies who were not resuscitated and further it was comparable till 60 minutes interval (p>0.050). Similar pattern of heart rate was noted in babies with low birth weight (<2.50 Kgs) and normal birth weight respectively (≥ 2.50 Kgs) whereas in babies with meconium stained liquor the mean heart rate was significantly high from sixth minute onwards to 40 minutes interval (p<0.050) compared to babies with clear meconium. These findings suggest that, there is significant variation in the heart rate among the babies with active resuscitation, low birth weight (<2.5 Kg), meconium stained liquor and warmer care compared to normal babies. It has been reported that, immediate skin to skin care improves mother and baby bonding.[12]

Oxygen saturation

In this study, oxygen saturation in newborns is low at birth which increases marginally during the first hour of life with drop at in between at 25 minutes interval.

In this study significant variation in oxygen saturation was noted among the babies with requirement of resuscitation, low birth weight and warmer care while no significant difference was noted in neonates with meconium stained liquor and clear liquor. The oxygen saturation was significantly high in babies who required resuscitation at one to three minutes and 20 to 60 minutes interval (p<0.050) whereas in babies with birth weight < 2.5 Kgs, oxygen saturation was significantly low from beginning to 15 minutes (p<0.050) and further though the oxygen saturation was low it was statistically not significant (p>0.050). The neonates on warmer care had significantly lower mean oxygen saturation (p<0.050) throughout the monitoring period compared to neonates who were on abdomen except at 3, 7, 9, 10 and 15 minutes interval (p>0.050). However, the mean oxygen saturation in neonates with meconium stained liquor and clear meconium was comparable (p>0.050). NRP recommends that, vigorous babies born out of MSAF can be given routine care.[13,14]

It is still unclear whether the oxygen saturation profile could be affected by racial/ethnic variation, birth weight, sex, APGAR score or maternal factors (age, hemoglobin, type of labor) in term healthy babies.[14]

Temperature

Neonates delivered by cesarean section may be depressed by drugs used in general anaesthesia during the immediate postnatal period.[15] In the present study, the mean peripheral and core temperature was significantly high in babies who were on abdominal care (p<0.050) compared to warmer care while the mean core and peripheral temperature in babies with normal and low birth weight were comparable. These findings describe the significant difference in core and peripheral temperature with abdominal and warmer care and support the WHO recommendation of initiating skin to skin care immediately after birth.

Continuous ambulatory recording was done in home delivered newborn infants during routine activities such as bathing, breast feeding, changing soiled diapers etc. The study highlighted factors that lead to interruption of warm chain during routine newborn care. Delivered on to ground (85.3%), body not wiped (81.6%), lies uncovered for >60 min(67.5%), bathed and scrubbed within 24 hours(88.6%), bathed 3-4 times in a week, messaged uncovered (89.5)%, massaged >3 times a week (49.8%), and prelacteal feeds given (80%) were the important factors noted.

Results from studies of central and peripheral temperatures and their differences during the immediate postnatal period in full-term neonates delivered vaginally and by cesarean section are inconsistent.[16-19]

Faxelius G et al, measured similar central and peripheral temperatures in neonates delivered vaginally and by cesarean section at the ages of 30 minutes and 2 hours although the sympathoadrenal activity differed between these two groups.[20]

Ylikorkala O et al, reported that the central-peripheral temperature difference was smaller in neonates born by cesarean section than in neonates born by vaginal delivery during the first hour of life. They attributed this difference to the decreased production of prostacyclin in infants born by cesarean section.[17]

These results agree with observations of Karlsson H et al, who measured skin temperatures in healthy, full-term neonates at a mean age of 3.5 days and found that the foot was the body part most reactive to operative temperature.[21] However, the mode of delivery was not reported in Karlsson's study. These findings suggest that vaginally delivered neonates had better-developed vasomotor control than neonates delivered by cesarean section during the immediate postnatal period. Our data raise the possibility that vasomotor response during the first 2 hours after birth is controlled by factors associated with the mode of delivery. Overall, the central and peripheral temperatures and the central-peripheral temperature differences were similar in full-term neonates delivered vaginally and by cesarean section under similar post-delivery care practices during the first 2 hours of life in above study. In our study vaginally delivered neonates had better temperature adaptation and faster improvement as compared to LSCS due to skin to skin care given to the babies in comparison to warmer care given babies born by LSCS.

CONCLUSION

The mean oxygen saturation in newborns was low at birth and increases marginally during the first hour of life. Further there was variation in oxygen saturation in babies with requirement of resuscitation, low birth weight and warmer care while in neonates with meconium stained liquor and clear liquor the oxygen saturation in comparable. The mean core and peripheral temperatures were low at birth and there was a steady increase till 60 minutes interval. The mean peripheral and core temperature were significantly higher in babies who were on abdominal care compared to warmer care but comparable in babies with normal and low birth weight. Also by the end of one hour from birth all the groups in this study had difference in core and peripheral temperature was more than 1.50 in all the groups at all the intervals until one hour of life.

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