

ORIGINAL ARTICLE

Noninvasive Blood Pressure Measurement In Newborn

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KEYWORDS : Blood Pressure, Non Invasive, Newborn

ABSTRACT

INTRODUCTION : Non invasive techniques estimate blood pressure by analysing changes in flow produced by compressing an artery in an extremity and monitoring an effect related to compression either by palpation or auscultation assessment or with some externally placed transducer.

AIMS AND OBJECTIVES : To study blood pressure measurement in neonates by indirect oscillometric method and pulse oximeter and to compare the both.

MATERIALS AND METHODS : This prospective study was conducted on 100 cases selected from L.G. Hospital. 50 neonates from NICU and 50 from postnatal wards were selected. Neonates requiring inotropes, crying neonates and congenital anomalies like CHD were excluded from the study. With an appropriate size cuff, blood pressure was recorded in neonates using indirect oscillometric method and pulse oximeter applied. Pressure was raised in 10mm increments every 5 seconds and the pressure at disappearance and reappearance of plethysmogram was noted and compared with blood pressure.

RESULTS : Mean systolic blood pressure in 50 sick and healthy term neonates by NIBP was 60.80+/-11.68 and 69.74+/- 8.55 mm of Hg respectively. Mean pressure of reappearance of BP in sick and healthy term neonates by pulse oximeter was 62.62+/- 12.68 and 73.36+/- 12.34 mm of Hg respectively. Blood pressure is affected by gestational age in weeks. It is lower in premature infants than full term infants.

CONCLUSION : Systolic BP correlated better with pulse oximeter BP recording taken at reappearance (RP) plethysmogram. This method of systolic blood pressure measurement is simple, non invasive, accurate and reliable.

INTRODUCTION

Blood pressure is an important parameter regularly monitored in critically ill neonates. The recognition and treatment of hypotension are particularly important to avoid complications such as cerebral ischemic injury or intraventricular haemorrhage. In neonates flush, palpation or auscultation methods were used initially. These methods are inaccurate, so are not used routinely now.

Noninvasive techniques estimate blood pressure by analysing changes in flow produced by compressing an artery in an extremity and monitoring an effect related to compression either by palpation or auscultation assessment or with some extremity placed transducer.

For more 20 years, Noninvasive blood pressure (NIBP) monitors have been widely used in intensive care units to closely monitor blood pressure (Systolic, Diastolic and mean arterial blood pressure) in patients of all ages from birth.

Blood pressure measurement by NIBP monitor by indirect oscillometric (Digital) method is non-invasive & accurate. In neonates by NIBP can not miss hypertension. NIBP monitor is useful for infants who require BP monitoring after discharge from the NICU e.g. neonates with Hypertension on anti-hypertensive treatment. By NIBP monitoring, patient's heart rate / Pulse rate are assessed simultaneously with Blood Pressure.

It was decided to study about blood pressure measurement by NIBP in NICU & normal neonates and these results were compared with the plethysmogram of pulse oximeter during slow inflation & deflation of cuff.

AIMS AND OBJECTIVES

1. To study blood pressure measurement in neonates by indirect oscillometric method (Digital method).
2. To study use of pulse oximeter to determine BP in neonates.
3. To study and establish reliability & accuracy in BP measurement by Indirect Oscillometric method by NIBP & compare with Pulse Oximeter.

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MATERIALS AND METHODS

Total 100 cases were studied. These cases were selected from L.G. Hospital. This prospective study was performed from Nov'05 to Dec'05.

Criteria for selection of cases: 50-Neonates admitted in NICU. 50-Neonates from post-natal wards of L.G.Hospital were taken in study.

Blood pressure was recorded: 1) 50 sick neonates of Age (>24 hours), Different maturity, Different sex. 2) 50 Healthy neonates of Age (>24 hours), Full-Term, Different sex.

Criteria for exclusion of cases: Neonates on inotropic agents, crying neonates and with congenital anomalies like CHD were excluded from study.

Blood pressure was recorded in right arm. A blood pressure cuff of appropriate size. Instruments by indirect oscillometric [Digital] method. In NICU Systolic, Diastolic and mean blood pressure were taken once. In post-natal 3-reading of Systolic, diastolic and mean blood pressure were taken. So neonates admitted in NICU single observations were taken by each method. Neonates not admitted in NICU 3 observations were taken by NIBP and single observation by Pulse oximeter.

Pulse oximeter probe was applied to ipsilateral finger. After pulse oximeter displayed a smooth plethysmogram, oxygen saturation and heart rate pressure in cuff was slowly raised in increments of 10mm/5sec and changes in plethysmogram observed.

The pressure at disappearance & reappearance of plethysmogram was noted to get mean of disappearance and reappearance. These values are compared with blood pressure taken by indirect oscillometric (Digital) method.

1. For n=50

Admitted in NICU						
	NIBP			Pulse Oximeter		
	SBP (mm of Hg)	DBP (mm of Hg)	Mean (mm of Hg)	DP	RP	MDr
Mean	60.8	35.34	44.2	82.36	62.62	72.49
S.D.	11.68	10.73	10.91	15.69	12.68	13.51

2. For n=50

NOT Admitted in NICU						
	NIBP			Pulse Oximeter		
	SBP (mm of Hg)	DBP (mm of Hg)	Mean (mm of Hg)	DP	RP	MDr
Mean	69.74	42.1	51.8	93.06	73.36	83.21
S.D.	8.54713	7.27941	6.36316	12.9653	12.34	11.37545

3. For n=100

Admitted and Not admitted in NICU						
	NIBP			Pulse Oximeter		
	SBP (mm of Hg)	DBP (mm of Hg)	Mean (mm of Hg)	DP	RP	MDr
Mean	65.27	38.72	48	87.71	67.99	77.85
S.D.	11.13	9.73	9.67	15.3	13.57	13.54

OBSERVATION AND DISCUSSIONS

- This prospective study was done in L.G. Hospital, total 100 cases were studied.
- 100 neonates of either sex Male = 48% Female = 53%. Age (1-28) days.
- Maturity (Full Term – 67%, Preterm – 33%).
- Healthy status (Sick-50%, Healthy-50%).
- Wt. [840gm-3.7kg] average wt. 2.258kg.
- Neonates admitted in NICU single observations were taken by each method. Neonates not admitted in NICU 3 observations were taken by NIBP and single observation by Pulse oximeter.
- Blood pressure was measured in 50 sick neonates in NICU.
- Mean systolic blood pressure by NIBP was 60.80+/- 11.68 mm of hg. In Avdhash et al, Girish et al study: 73.92+/-13.60 mm of hg.
- Mean blood pressure by NIBP was 44.20+/-10.91 mm of hg.
- The mean pressure of Disappearance and reappearance (MDr) by Pulse Oximeter 72.49+/- 13.51 mm of hg. In Avdhash et al, Girish et al study: 83.46+/-10.98 mm of hg.
- Blood pressure was measured in 50 healthy term infants not admitted in NICU.
- Mean blood pressure by NIBP was 51.80+/-06.36 mm of hg. In Park et al, Myungk et al study: 49.80+/-07.00 mm of hg
- The mean pressure of Disappearance and reappearance (MDr) by Pulse Oximeter 93.06+/- 12.97 mm of hg. In Park et al, Myungk et al study: 95.12+/-11.56 mm of hg

- Mean Systolic Blood Pressure by NIBP was: 65.27+/-11.13 mm of Hg. In Avadhesh et al, Girish et study: 73.92+/-13.06 mm of Hg.
- Mean Diastolic Blood Pressure by NIBP was: 38.72+/- mm of Hg.
- Mean Blood Pressure by NIBP was: 48.00+/-09.67 mm of Hg.
- The Mean Pressure of Point of Disappearance by pulse Oximeter was: 87.71+/-15.30 mm of Hg. The Mean Pressure of Point Of reappearance by Pulse Oximeter was:67.99+/-13.57 mm of Hg. In Avdhesh et al, Girish et al Study: 71.88+/-12.08.
- The Mean pressure of Disappearance & reappearance by Pulse Oximeter : 77.85+/-13.54 mm of Hg. In Avdhesh et al, girish et al study: 83.46+/-10.98 mm of Hg.
- Correlation coefficient of point of Reappearance with Systolic Blood pressure by NIBP: 0.89. In Avdhesh et al, Girish et al Study: 0.89.
- Mean Systolic Blood Pressure by NIBP better correlate with Pulse Oximeter BP reading taken of Reappearance of plethysmogram. Point of Disappearance and Mean of Disappearance & Reappearance also correlate with Systolic BP but on an average gives higher values.

4. For n=33

Preterm			
Gestational week	NIBP		
	SBP (mm of Hg)	DBP (mm of Hg)	Mean (mm of Hg)
<24 Weeks	47-59	25-32	34+/-6
24-28 Weeks	47-58	24-38	38+/-6
29-32 Weeks	46-61	27-36	41+/-6
>32 Weeks	52-62	30-39	46+/-4

Blood pressure recorded in preterm from < 24 weeks to >32 weeks

1. <24 Weeks – Mean Blood pressure by NIBP: 34+/-6 mm of Hg
2. 24-28 Weeks – Mean Blood Pressure by NIBP: 38+/-6 mm of Hg
3. 28-32 Weeks – Mean Blood Pressure by NIBP: 41+/-6 mm of Hg
4. 32 Weeks – Mean Blood Pressure by NIBP: 46+/-4 mm of Hg

5. n=16

Term Infants				
Days		NIBP		
		SBP	DBP	Mean
Day-2	Sleep	65+/-9	38+/-6	46+/-4
Day-2	Awake	69+/-7	39+/-6	51+/-6
Day-3	Sleep	69+/-5	41+/-6	52+/-6
Day-3	Awake	71+/-11	43+/-8	53+/-5
Day-6	Sleep	73+/-5	48+/-10	57+/-9

Blood pressure was measured according to days of life with awake and sleeping infants.

Above study shows that

1. Systolic blood pressure and Diastolic blood pressure is increasing with increasing days of life in full term infants.
2. Mean arterial blood pressure increases in postnatal age by 1 to 2 mm of Hg during first week of life in full term infants.
3. Blood Pressure measured in awake (n=16) infants had B.P. values 4 to 5 mm of hg greater than quiet infants. (Myung k , Park et al)

6. n=32

Low Birth Weight			
Weight	NIBP		
	SBP (mm of Hg)	DBP (mm of Hg)	Mean (mm of Hg)
751-1000	47-58	52-30	31+/-3
1001-1250	48-59	27-38	37+/-7
1251-1500	47-58	22-36	37+/-4
1501-1750	48-60	24-36	39+/-5
1751-2000	48-62	24-39	45+/-6

Above study shows

1. Blood pressure is affected by birth weight. It is lower in LBW infants than in full term newborn [Emery & Greenough – 1992 , Hegi et al -1994] Nuntnarumit et al -1999
2. In this study blood pressure is lower in premature infants than full term infants.

SUMMARY AND CONCLUSION

This prospective study was done at L.G. Hospital. Total 100 cases were studied. Noninvasive blood pressure monitors have been useful in intensive care units to monitor systolic, diastolic and mean arterial blood pressure simultaneously.

We can rapidly identify change in blood pressure in critically ill neonates.

[Mean systolic blood pressure in 50 sick neonates by NIBP was 60.80±11.68 mm of Hg. Mean blood pressure in 50 sick neonates by NIBP was 44.20±10.91 mm of Hg.

Mean pressure of Reappearance in sick neonates by pulse oximeter was 62.62±12.68 mm of Hg.

Mean SBP in 50 healthy term neonates by NIBP was 69.74±08.55 mm of Hg.

Mean blood pressure in 50 healthy term neonates by NIBP was 51.80±6.36 mm of Hg.

The mean pressure of Reappearance in 50 healthy term neonates by Pulse Oximeter was 73.36±12.34 mm of Hg]

Blood pressure is affected by gestational age in weeks. It is lower in premature infants than full term infants.

Mean blood pressure by both the method (NIBP&Pulse oximeter) was on lower side in case of sick neonate.

SBP and DBP is increasing with increasing days of life in full term infants. Mean arterial blood pressure increase in postnatal age by 1 to 2 mm of hg during first week of life in full term infants.

Systolic BP correlated better with pulse Oximeter blood pressure recording taken at reappearance of plethysmogram while deflating the BP cuff.

This method of systolic blood pressure measurement is simple, noninvasive, accurate and reliable. Hence, it is recommended for use in neonates when other reliable methods of BP recording are not available.

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