



MONITORING OF THE BLOOD PRESSURE IN NEWBORN

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**ABSTRACT**

**Aims and Objectives :**To know the relationship of blood pressure with the postnatal age ,birth weight and sex. **Setting and Design.** It was a hospital based prospective study, conducted in postnatal ward of tertiary care government hospital of Ahmedabad from jan 2016 to dec 2016. **Material and method.** 321 intramural term neonates without any postnatal problems were enrolled in the study. Blood pressure was measured with the help of NIBP monitor when child was awake. BP was recorded on day 1,day 2 and day 3. Data was analysed. **Observations:** Out of 321 newborns 110 were males and 211 were females. Out of 321 newborns 267(83.17%) were normal weight babies and 54(16.54%) were low birth weight babies. Average SBP increases 1.37 mm of Hg on day 2 and 2.88 mm of Hg on day 3. Average DBP increases 1.34 mm of Hg on day 2 and 2.65 mm of Hg on day 3. Average MBP increases 1.28 mm of Hg on day 2 and 2.64 mm of Hg on day 3. Average BP is higher in normal birth weight neonates than LBW neonates on all postnatal days. No significant difference in the BP of male and female neonates was noted. **Conclusions:** BP increases as the postnatal age increases. BP is higher in normal birth Wt babies than LBW babies. BP has no relationship with sex.

**KEYWORDS :** NIBP, oscillatory method, postnatal age, low birth weight.

**Introduction:**

Measurement of blood pressure in the neonate is becoming routine practice.1st BP measurement in the neonate was performed by direct determination of BP through an umbilical artery in 1879. Since then , the ever increasing body of information on arterial blood pressure in the newborn has generated many new and as yet unanswered questions. Measurement of BP in the neonate can be performed by mainly two methods. Non invasive and invasive. Non invasive methods are more easier and popular .They are palpatory, auscultatory, flush method, Doppler ultra sound and oscillometry method. Invasive methods are more accurate but they are less preferred because of some limitations.Following table shows the normal values blood pressure in term neonates.

**Values of B.P. in normal Term Neonates**

Age	State	SBP(mm Hg)	DBP (mmHg)	MAP(mmHg)
1 <sup>st</sup> day	Asleep	70 ±9	42 ±12	55 ±11
	Awake	71 ±9	43 ±10	55 ±9
3 <sup>rd</sup> day	Asleep	75 ±11	48 ±10	59 ±9
	Awake	77 ±12	49 ±10	63 ±13
6 <sup>th</sup> day	Asleep	76 ±10	46 ±12	58 ±12
	Awake	76 ±10	49 ±11	62 ±12

Principle of NIBP: A sensitive transducer that measure static pressure and pressure oscillation received and transmitted by the cuff. Readings may differ when NIBP pulse rate is compared with ECG wave form. As NIBP parameter measures actual peripheral pulses , not electrical signals or contractions of the heart,differences may occur because cardiac electrical signals may fail to produce peripheral pulse occasionally. NIBP may give false high BP if cuff is too short and false low BP if cuff is tied too loose .Selection of the appropriate site for NIBP: Generally right upper limb is selected for NIBP monitoring. Intravenous lines ,catheters etc. Prohibits use of that arm, so recess the optimal site. The neonate's cardiovascular status and the effect of an alternative site has on BP values, proper cuff size and infant comfort are important considerations. Evaluate the potential impact and the clinical significance of any potential differences before deciding to use an alternative site for cuff placement. Take care while placing the cuff on extremity being used to monitor other vital sign parameter such as pulse oximetry, which also uses the pulse for determination of values. Do not apply cuff to non intact skin. Selection of the proper cuff size for NIBP monitoring: NIBP cuffs are disposable, cost effective, economical enough for single patient use.It prevents costly disinfection procedures and contamination concerns. It is latex free and available in soft white fabric material or flexible white vinyl material. The accuracy of NIBP

monitoring depends on using a properly sized cuff. Appropriate sized cuff should cover 2/3 of upper arm or it should be 20% wider than the diameter of the upper limb. A cuff that is bigger causes only a small decrease in accuracy. However, using a cuff that is too small may result in proportionally greater errors, leading to erroneously high readings. To ensure the cuff size and fit are appropriate, measure the infant's limb circumference by placing a measure tape around the mid point of the limb.

No.	MAC(cm)
1	3.3-5.6
2	4-8
3	5.4-9
4	6.9-11.7

Compare the neonate's limb circumference to the circumference ranges marked on the cuff or its packaging. In addition to the printed numerical circumference ranges, some cuff has printed index lines on them to provide an easy view of proper fit for the infant's limb. The cuff index line on the one side of the cuff must fall within range marking on the other side of the cuff. Some NIBP provide a variety of cuff sizes that fit the same limb circumference. Yet have different widths that may fit different limb length. Avoid using a cuff with width that extend over a joint. When cuff sizes overlap for a measured circumference, try the different appropriate sizes on the limb and choose the larger size cuff as long as the cuff width does not extend on or below any joint on the limb. After choosing, inspect the cuff for its structural integrity. Proper cuff application: Some cuff has artery mark indicators to guide placement. To apply the cuff within an artery mark, palpate the neonate's artery and than place the cuff so that the artery is aligned in with the mark. Squeeze all the air from the cuff before applying it on neonate's limb. If upper limb is used place the cuff as far proximally as possible to avoid compression on ulnar nerve at the elbow. Wrap the cuff snugly around infant' limb. However it should not be so tight that it impedes the venous return between BP measurements. Ensure that hook and loop closures are properly engaged so that pressure is evenly distributed throughout the cuff. Connect the cuff to the air hose of the NIBP monitor: Confirm that the connection is secure and un occluded and that the tubing is not kinked. Do not inflate the cuff when it is not around the limb. Use only manufacturer's recommended air hose and other accessories otherwise it may lead to inaccurate readings. Any attempt to modify an air hose from the manufacturer's original specifications may defeat certain patient safeguards. One such safeguard may keep the NIBP monitor from switching to adult measurement mode. Activate the device and start the NIBP measurement:The neonate should be quite and restful throughout the BP measurement. Movements.

especially of the cuffed extremities should be avoided as it may affect the accuracy of the BP measurement. Removing the cuff and reassessing the extremities: The cuff should be removed when the monitor's power is off. If the remains in the place when the monitor is powered off, or if the interval between BP measurement is prolonged frequently observe the limb and rotate the site of cuff placement as needed. Some monitors can be set to take BP measurement at programmed intervals. NIBP devices exert pressure on tissue, may some times leads to purpura, skin avulsion, compartmental syndrome, ischemia and/or neuropathy. To minimize these problems, apply the cuff appropriately and examine the site distal to the cuff frequently for signs of impeded blood flow.

**Materials and methods:** it was a hospital based prospective study, conducted in the postnatal ward of a tertiary care hospital tenured from January 2016 to December 2016. All intramural term neonates without any postnatal problems or NICU admissions were included in the study. Sample size was decided by following formula:  $n=4SD^2/L^2$  (SD is standard error of previous study =4, L is allowable error = 0.5). So according to that 321 term neonates were enrolled in the study. Blood pressure was taken during awake state of baby (stage 3). NIBP monitor (MEK intensive monitor MP 570) was used for BP monitoring. As per standard guideline, appropriate sized BP cuff was used for accurate measurement of blood pressure. It was applied on right upper arm with autoclaved cotton inbetween the arm and the cuff to prevent pressure changes. Cuff was connected to the NIBP monitor in inflated automatically. Three readings of SBP, DBP and MAP were taken on day 1, day2 and day 3. All the details were recorded in preformed proforma. Following non parametric tests were applied and data was analysed. 1) Wilcoxon signed ranks test 2) Friedman test 3) Chi square test

**Observations and Discussion:** Total 321 term neonates were included in the study. Among them, 110 were male and 211 were female. 267 neonates were of > 2.5 kg birth weight and 54 were of < 2.5 kg birth weight.

**Table 1**  
**Average values of HR, RR, SPO2 & BP on postnatal day 1,2 & 3**  
**n = 321**

Vital parameters	Day 1	Day 2	Day 3
SBP (mm of Hg)	64.70	66.07	67.58
DBP (mm of Hg)	34.72	36.06	37.37
MAP (mm of Hg)	44.21	45.49	46.85

Average values of SBP on postnatal days 1,2 and 3 were 64.70 + 7.08, 66.07 + 6.66 and 67.58 + 6.6 respect. Average values of DBP on postnatal days 1,2 and 3 were 34.72 + 6.18, 36.06 + 6.12 and 37.37 + 5.98. Average values of MAP on postnatal days 1,2 and 3 were 44.21 + 5.74, 45.49 + 5.06 and 46.85 + 4.94. Average SBP increases 1.37 mm of Hg on day 2 and 2.88 mm of Hg on day 3. Average DBP increases 1.34 mm of Hg on day 2 and 2.65 mm of Hg on day 3. Average MBP increases 1.28 mm of Hg on day 2 and 2.64 mm of Hg on day 3. So SBP, DBP and MAP increases as the postnatal age increases. (p value < 0.0001, significant)

**Table 2**  
**Relationship between BP and Birth weight**

BP (mm Hg)	Birth wt	DAY 1	DAY 2	DAY 3
SBP	≥ 2.5	65.52	66.83	68.32
	< 2.5	60.44	62.13	63.73
DBP	≥ 2.5	35.29	36.65	37.95
	< 2.5	31.81	33.02	34.37
MAP	≥ 2.5	44.84	46.11	47.46
	< 2.5	40.95	42.3	43.0

On all postnatal days, SBP, DBP and MAP are higher in normal birth weight neonates than LBW neonates. (p value < 0.0001 significant)

**Table 3**  
**Average values of BP in Male & Female neonates**

BP (mm Hg)	DAY 1		DAY 2		DAY 3	
	M	F	M	F	M	F
SBP	64.03	65.45	65.51	66.36	66.43	67.66
DBP	34.31	34.94	35.65	36.27	36.94	37.60
MAP	43.92	44.35	45.14	44.67	46.50	47.04

On day 1 and 3, average SBP, DBP and MAP is higher in females than males. (p value not significant.) On day 2, average SBP and DBP is higher in females than males but MAP is lower in females than males. (p value not significant)

**Conclusions:**

Average SBP, DBP and MAP increases as the postnatal age increases (first 3 days of life)  
Average SBP, DBP and MAP are higher in normal birth weight neonates than LBW neonates.  
No relationship between BP and sex is established.

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