

ORIGINAL RESEARCH

The effect of Nuchal cord on umbilical cord blood gases and associated neonatal outcome: A prospective study

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ABSTRACT

Background: Nuchal cord compression is very common and causes common complications in newborns like meconium excretion, abnormal fetal heart rate pattern, low APGAR score, IUFD, IUGR, NICU admissions, cerebral palsy, hypoxic brain injury and HIE. Hence it needs to be studied. **Materials & Methods:** Prospective observational study conducted on women admitted in labor ward of SMGS hospital over a period of one year (w.e.f. 1st November 2021 to 31st October 2022). 2 groups of 150 patients each studied i.e. Group A with patients delivering baby with nuchal cord and Group B with patients delivering baby without nuchal cord. Objectives of the study were to compare umbilical cord blood gas analysis, APGAR scores (1 & 5 min), duration of labour and fetal outcomes in the 2 groups. Females between 18 to 40 years of age with term cephalic singleton pregnancy with spontaneous onset of labour were included and those with predetermined fetal and maternal risk factors were excluded. Data analysis done using statistical methods. **Results:** Maternal age, gestational age, gravidity, number of loops of nuchal cord, birth weight do not show much importance in occurrence of nuchal cords. Umbilical cord arterial blood gas analysis shows lower pH, lower mean pO₂ and raised pCO₂ in patients with nuchal cord however no difference in mean HCO₃⁻ and base excess seen. Labour duration not prolonged and instrumental delivery not increased with nuchal cord. Fetal and Neonatal complications had similar occurrence in both the groups. **Conclusion:** Presence of nuchal cord may negatively affect the umbilical cord blood gases but not associated with adverse perinatal complications, however detailed studies are further needed to support this result.

Key Words: Nuchal cord, Umbilical cord blood analysis

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INTRODUCTION

Umbilical cord connects the fetus to the placenta. It comprises of the connecting stalk, vitelline duct and umbilical vessels (2 arteries and one vein at term).¹ The 2 umbilical arteries carries deoxygenated blood with blood products from fetus to placenta and umbilical vein carries oxygenated blood with nutrients from placenta to the fetus and hence are essential for fetal gas exchange.² Nuchal cord occurs when umbilical cord become wrapped around the fetal neck in 360 degree. It has the prevalence rate of 6- 37%. It is of two types, Type A when encircles the fetal neck in an unlocked pattern (mostly gets resolved) and Type B when encircles the fetal neck in a locked pattern. Nuchal cord compression raises fetal arterial resistance causing fetal bradycardia, fall in cardiac output causing hypoxemia, hypercapnia and acidosis in fetus.³ This leads to short and long-term

complications in newborns like meconium excretion, abnormal fetal heart rate pattern, Apgar scores at 5 minutes <7, intrauterine fetal death, intrauterine growth restriction, cerebral palsy, hypoxic brain injury, HIE and cesarean section.⁴

Umbilical cord blood gas analysis can give an indication of preceding fetal hypoxia. Umbilical cord arterial blood sample is used to assess acid base parameters to assess neonatal hypoxia.⁵ The reference range for arterial cord blood pH is 7.12 to 7.35 and for arterial cord BD is +9.3 to -1.5 mmol/l.⁶ According to the American College of Obstetricians and Gynecologists (ACOG) and American Academy of Pediatrics (AAP), cord arterial blood pH <7.0 or a base excess (BE) <12 mmol/L are accepted cutoff values for pathological acidosis.⁷ This study was done with the main aim of analysing the effect of nuchal cord on

fetus outcome and duration of labour using the umbilical cord blood analysis.

MATERIALS AND METHODS

This is an prospective observational study conducted on women admitted in labor ward in Department of Obstetrics and Gynecology of SMGS Hospital Jammu, over a period of one year (w.e.f. 1st November 2021 to 31st October 2022) after proper institutional ethical approval and informed written consent from the participants. Patients were divided into 2 groups of 150 patients each i.e. Group A with patients delivering baby with nuchal cord and Group B with patients delivering baby without nuchal cord.

Aims and objectives of the study were to compare the umbilical cord blood gas analysis, APGAR scores (1 & 5 min), duration of labour and fetal outcomes in the 2 groups. Patients between 18-40 years of age with term cephalic singleton pregnancy with spontaneous onset of labour with intact membrane were included. Patients with multifetal gestation, malpresentation, postdated pregnancies, PROM, congenital anomalies, FGR, abnormal umbilical Doppler study, APH and other antenatal complication such as gestational hypertension, preeclampsia, eclampsia, cardiac disease etc were excluded from the study.

Age, parity, gestational age of the patient, intrapartum fetal heart rate, umbilical cord blood gas analysis (2-3 ml of cord arterial blood sample taken at birth before delivery of placenta in a pre-heparinized syringe), mode of delivery, duration of labor (from 4 cm dilated cervix till third stage of labor), Apgar score at 1 and 5 minutes, birth weight, presence of meconium and fetal complications were recorded. Data was compiled using microsoft excel. Student's independent t-test or Mann-Whitney U-test, Chi-square test or Fisher's exact test, whichever appropriate, were applied.

RESULTS

Majority of the women were between 25 to 29 years of age with the mean age of 26.5 ± 4.19 and 25.9 ± 3.73 years in group A and B which was not statistically significant. The difference of gravidity in

the 2 groups was found to be statistically insignificant. Mean gestational age in group A and group B were 38.63 ± 1.29 and 38.72 ± 1.08 weeks. Table no 1 describes the above mentioned parameters. In Group A, 123 neonates had single nuchal cord (82%) and 27 neonates had multiple nuchal cords (18%). 14 patients (9.3%) in group A and 8 patients (5.35%) in group B had fetal bradycardia and 2 patients (1.35%) in group A and 1 (0.7%), in group B patient had fetal tachycardia although this difference is insignificant. On doing Umbilical cord blood analysis mean pH and mean pO₂ was found to be lower in group A (7.22 ± 0.093 , 22.6 ± 3.78) as compared to group B (7.25 ± 0.058 , 32.7 ± 5.56) which is statistically significant (p value < 0.001, p value = 0.002). Mean pCO₂ was more in group A (54.5 ± 7.91) than group B (46.5 ± 5.39) and this difference was also statistically significant (p value < 0.001) However mean HCO₃⁻, mean oxygen saturation and mean base excess in group A were 21.3 ± 3.86 , 55.9 ± 5.42 mmol/l and -7.14 ± 2.63 vs 20.7 ± 3.59 , 56.5 ± 3.72 and -6.72 ± 2.29 mmol/l in group B and the difference is statistically insignificant. Mean duration of different stages of labour in the 2 groups were found to be statistically insignificant in all 3 stages of labour with p value of > 0.005. Hence labour duration is invariable of presence or absence of nuchal cord. Statistically insignificant difference (p value = 0.114) was seen in the occurrence of instrumental delivery in the 2 groups. Mean birth weight was 2.83 ± 0.421 kg in group A and it was 2.85 ± 0.367 kg in group B and this difference was statistically insignificant (p value = 0.738).

Difference in APGAR score in group A and group B was not statistically significant p value being 0.113 at 1 minute and 0.437 at 5 minutes. NICU admissions, IUGR, meconium aspiration and oligohydramnios were seen in 31 (20.7%), 12 (8%), 22 (14.7%) and 24 (16%) neonates in group A and in 21 (14%), 8 (5.3%), 13 (8.7%) and 21 (14%) neonates in group B. Therefore fetal complications are equally prevalent in both groups and the difference is statistically insignificant.

Table no 1: Distribution of parameters in 2 groups

S.NO	Parameter	Group A(n=150)	Group B (n=150)	P -value
1	Age of the patient	20-24 Years	50	0.164
		25-29 Years	63	
		≥ 30 Years	37	
		Mean±SD	26.5 ± 4.19	
2	Gravidity	Primi Gravida	62	0.105
		Multi Gravida	88	
3	Mean gestational age	38.63 ± 1.29	38.72 ± 1.08	0.507

Table no 2: Comparison of results in Group A and B

S.NO	Parameter	Group A(n=150)	Group B (n=150)	P -value
1	Intrapartum fetal heart rate	Bradycardia	14	0.184
		Tachycardia	2	1.000
2	Umbilical cord blood analysis	Mean pH	7.22 ± 0.093	7.25 ± 0.058
		Mean pO ₂	22.6 ± 3.78	32.7 ± 5.56

		Mean pCO ₂	54.5±7.91	46.5±5.39	<0.001*
		Mean HCO ₃ ⁻ (mmol/l)	21.3 ± 3.86	20.7 ± 3.59	0.164
		Mean base excess(mmol/l)	-7.14 ± 2.63	-6.72 ± 2.29	0.142
		Mean oxygen saturation(%)	55.9±5.42	56.5±3.72	0.223
4	Duration of labour (mean duration)	Ist stage (min)	354.1 ± 104.7	351.2 ± 95.2	0.795
		2nd stage(min)	30.3 ± 15.82	32.6 ± 14.69	0.193
		3rd stage(min)	3.1 ± 0.962	2.9 ± 0.923	0.392
5	Instrumental delivery	Yes	23	14	0.114
		No	127	136	
6	Mean birth weight		2.83±0.421	2.85±0.367	0.738
7	APGAR score (mean score)	1 minute	9.23±2.24	9.61±1.89	0.113
		5minute	9.68±1.81	9.83±1.52	0.437
8	Fetal complications	NICU admission	31	21	0.127
		IUGR	12	8	0.354
		Oligohydramnios	24	17	0.239
		Meconium aspiration	22	13	0.106

DISCUSSION

We observed no difference between age of mother, gestational age, parity of women between 2 groups consistent with the study of Miser WF, 1992 and Zanjani MS et al., 2011.^{8,9} However Onderoglu LS et al., 2008 showed more incidence of nuchal cord in multigravida.¹⁰

The present study showed that nuchal cord around neck is associated with statistically significant low umbilical cord arterial pH as compared to absence of nuchal cord (7.22 vs 7.25, p value =0.002). Zanjani MS et al., 2011 (7.21 ±0.1 vs 7.28 ±0.1, p value 0.001), Onderoglu LS et al., 2008 (pH 7.32 vs 7.30, p value 0.048) and Kazemi S et al., 2020 (6.94 to 7.31 vs 6.67 to 7.40, p value<0.005) reported similarly.^{9,10,11} However Akkaya H et al., 2017 showed no such statistically significant difference.¹²

In our study mean O₂ saturation in 2 groups was not statistically significant (55.9 vs 56.5) which is inconsistent to studies by Onderoglu SL et al., 2008 (57.4±21.8 vs. 48.3±20.4, p=0.005) and Martin et al., 2005 (57.4±21.8 vs. 48.3±20.4, p=0.005).^{10,13} In the study by Onderoglu SL et al., 2008 umbilical cord pO₂ (37.4±18.1 vs. 31.7±14.4, p=0.01) is significantly lower in the NC group compared with the controls which is similar to our study(22.6±3.78 vs.32.7±5.56, p<0.001).¹⁰ In the present study there is no difference in HCO₃⁻ between the 2 groups, (p = 0.16), similar to the study by Onderoglu SL et al., 2008 (p=0.95) and Kazemi S et al., 2020 (p=0.722).^{10,11} In our study pCO₂ was more in nuchal cord group (mean 54.5 vs 46.5) inconsistent to studies by Karunidhi S et al., 2015 and Kazemi S et al., 2020.^{4,11} The difference in mean base excess between the 2 groups is statistically insignificant in our study unlike in study by Zanjani MS et al., 2011 (p value=0.001).⁹ In present study no difference seen in birth weights of group A vs group B (p=0.738) which is similar to Karunidhi Set al., 2015 (p=0.823) but indifferent to study by Lipitz et

al., 1993 (more incidence of NC in babies with birth weight <2 kg) .^{4,14}

In our study intrapartum abnormal fetal heart rate patterns were not significantly different in fetuses with or without nuchal cord unlike findings of Karunidhi S et al., 2015 (P=0.005).⁴ Mastrobattista JM et al., 2005, as in our study stated that nuchal cord loops are not associated with increased fetal heart rate irregularities unlike by Larson et al., 1995.^{15,16}

In present study, no difference between APGAR score at 1 and 5 minutes in the two groups similar to study by Zahoor et al., 2014.¹⁷ However Karunidhi S et al., 2015 reported more incidence of APGAR score <7 at 1 min in study group and Larson et al., 1995 reported that presence of multiple NC was associated with low Apgar scores at 1 minute.^{4,16}

No significant increase in rate of instrumental delivery in was seen in nuchal cord group in our study (15.3% vs 9.3%) similar to the study of Mastrobattista JM et al., 2005 while in study by Meena P et al., 2018, incidence of instrumental delivery was 1% in nuchal cord group vs 0% in no nuchal cord group.^{15,18}

We observed that nuchal cord is not associated with prolongation of labour, similar to the study by Karunidhi S et al., 2015 and Najam S et al., 2020.^{4,20}

In the present study occurrence of meconium in the 2 groups was statistically insignificant (p =0.106) similar to study by Karunidhi S et al., 2015 (p=0.131).⁴ However, Onderoglu LS et al., 2008 stated that meconium staining of liquor is more common in newborns with multiple nuchal cord loops (31.3% vs. 15.6%, p=0.04).¹⁰

In the present study, there was not much difference between fetal complications like IUGR, oligohydramnios and NICU admissions between the 2 groups (p = 0.354, 0.239 and 0.127). Similar results were reported by Onderoglu LS et al., 2008 (p=0.54, 0.24 and 0.32).¹⁰

CONCLUSION

It can be concluded that presence of nuchal cord may negatively affect the umbilical cord blood gases but not associated with adverse perinatal complication and such patients can undergo uneventful vaginal delivery, but one should be vigilant while delivering the baby with cord around neck. Doing elective caesarean section for ultrasonographically diagnosed nuchal cord loop only increases maternal morbidity without any significant neonatal outcome. Overall, no increase in short-term maternal or neonatal adverse outcomes with nuchal cord observed in this study. However more studies are further needed to conclude the same.

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CONFLICTS OF INTEREST

None

REFERENCES

1. **Heil JR, Bordoni B.** Embryology, Umbilical Cord. 2021 Apr 28. In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2021 Jan; 32491422.
2. **Joshi K, Saxena R, Bhat M, Lomrod Y, Verma K.** Incidence of cord around neck and its effects on labour and neonatal outcome. *Adv Hum Biol* 2017;7:15-8.
3. **James LS, Weisbrot IM, Prince CE, Holaday DA, Apgar V.** The acid-base status of human infants in relation to birth asphyxia and the onset of respiration. *J Pediatr* 1958;52(4):379-94.
4. **Karunanidhi S, Ghose S, Pallavee P, Begum J, Rathod S.** Maternal and neonatal outcome in newborns with nuchal cord loop: a comparative study. *International Journal of Reproduction, Contraception, Obstetrics and Gynecology* 2015;4(4):1122-7.
5. **Higgins C.** Umbilical cord blood gas analysis. *Acutecaretesting.org* 2004;1-9.
6. **Knutzen L, Svirko E, Impey L.** The significance of base deficit in acidemic term neonates. *Am J Obstet Gynecol* 2015;213(3):373-7.
7. **Gillam-Krakauer M, Carter BS.** Neonatal hypoxia and seizures. *Pediatr Rev* 2012;33:387-96.
8. **Miser MWF.** Outcomes of infants born with nuchal cord. *J Fam Pract* 1992;34:441-45.
9. **Zanjani MS, Adib NE.** Umbilical cord blood gases in newborns with or without nuchal cord: a comparative study. *Tehran University of Medical Sciences* 2011;69:315-21.
10. **Onderoğlu LS, Dursun P, Durukan T.** Perinatal features and umbilical cord blood gases in newborns complicated with nuchal cord. *Turk J Pediatr* 2008;50(5):466-70.
11. **Kazemi S, Seyedehhajarsharjami, Hosseinzadeh F, Kabodmehri R, Forouzan F, Alirezaforouzan et al.** The Effect of Nuchal Cord on Umbilical Cord Blood Gases and Neonatal Outcomes. *Pakistan Journal of Medical and Health Sciences* 2020;14:829-35.
12. **Akkaya H, Buke B, Pekcan MK, Şahin K, Uysal G, Yegin GF et al.** Nuchal cord: is it really the silent risk of pregnancy? *The Journal of Maternal-Fetal and Neonatal Medicine* 2017;30(14):1730-3.
13. **Martin G, Green R, Holzman I.** Acidosis in Newborns with Nuchal Cords and Normal Apgar Scores. *J Perinatol* 2005;25:162-65.
14. **Lipitz S, Seidman D, Gale R, Stevenson D, Alcalay M, Menczer J, et al.** Is fetal growth affected by cord entanglement? *Journal of perinatology: official journal of the California Perinatal Association* 1993;13(5):385-8.
15. **Mastrobattista JM, Hollier LM, Yeomans ER, Ramin SM, Day MC, Sosa A et al.** Effects of nuchal cord on birthweight and immediate neonatal outcomes. *Am J Perinatol* 2005 Feb;22(2):83-5.
16. **Larson JD, Rayburn WF, Crosby S, Thurnau GR.** Multiple nuchal cord entanglements and intrapartum complications. *Am J Obstet Gynecol* 1995; 173: 1228-1231.
17. **Zahoor F, Sabir S, Yasmeen S.** Outcomes of trial of labour of nuchal cord. *Journal of Medical Sciences* 2014;22(2):66-8.
18. **Meena P, Bhojwani P, Verma GS.** Effect of nuchal cord on fetomaternal outcome. *Int Journal of Cl Obst and Gynaecol* 2018;2(5):19-23.
19. **Najam S, Malik SE, Aqeel S, Rizwan N, Haider AR.** Effect of nuchal cord on duration of labor. *Int J Health Sci Res* 2020; 10(7):51-56.