

A STUDY OF NUCLEATED RED BLOOD CELLS IN CORD BLOOD OF NEONATES BORN WITH MECONIUMSTAINED AMNIOTIC FLUID WITH RESPIRATORY SYMPTOMS AND IN THOSE BORN WITH CLEAR AMNIOTIC FLUID

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KEYWORDS ABSTRACT

MECONIUMSTAINED, fetal, IUGR, , LW babies **Introduction:** Meconium, a fetal secretion, can cause life-threatening respiratory disease in newborns, requiring early identification and intervention to improve outcomes and avoid costly treatment. **Aims:** The study compares NRBC/100WBC levels in neonates with meconium-stained amniotic fluid and clear amniotic fluid to assess respiratory symptoms severity. **Methodology:** The study involved twelve newborns at Krishna Hospital, Karad, with respiratory symptoms, clear amniotic fluids, or no symptoms. The study included 36 newborns, analyzed for hemoglobin percentage and white blood cell count, and excluded mothers with pre-pregnancy or labor-related conditions. **Results:** The study compared newborns' gestational age, birth weight, haemoglobin levels, WBC count, NRBC count/100 WBC, ESR, and respiratory symptoms in three groups, finding no significant differences. **Discussion:** Meconium stained amniotic fluid (MASAF) is a common condition in pregnancies, causing cardiovascular and inflammatory responses in newborns, particularly in developing countries with inadequate antenatal care. **Conclusion:** The study reveals that newborns with MASAF and respiratory symptoms have higher NRBC counts, suggesting they can be used to evaluate hypoxia and predict meconium aspiration.

INTRODUCTION

Meconium, derived from the Greek word "meconium-arion," means opium-like and was named by Aristotle due to its believed to promote fetal sleep during gestation. [1]

Meconium is typically present in the fetal ileum within 10-16 weeks of gestation. [2]

Meconium, the first stools a newborn passes, is typically passed within 24 hours of birth by over 90% of newborns. [3]

Meconium is a fetal secretion containing urine, lanugo, hair, vernix, and other desquamated epithelial cells from the mouth, skin, alimentary tract, and vernix. [1]

Meconium aspiration syndrome (MAS) is a condition characterized by respiratory distress in neonates born through meconium stained amniotic fluid, characterized by characteristic radiological changes. [3]

Meconium aspiration syndrome, a life-threatening respiratory disease, is characterized by signs such as tachypnoea, bradycardia, cyanosis, and hypotonia at birth. The cause is believed to be bile salts, and its concentrations vary with gestational age. [1]

A study in Tamilnadu found a 12.8% incidence of meconium aspiration syndrome among newborns with meconium stained amniotic fluid. [4]

A study at Vasantnao Naik Government Medical College in Maharashtra found that meconium stained amniotic fluid complicates delivery in 8% to 25% of live births, with 5% of neonates developing meconium aspiration syndrome. [3]

Meconium aspiration syndrome develops in newborns when fetus passes meconium 3-4 hours before delivery, increasing fetal hypoxia risk, abnormalities, low apgar scores, and fetal deaths. [5]

Chronic fetal hypoxia leads to increased erythropoiesis in infants with meconium aspiration. Early identification and intervention can improve outcomes and avoid expensive treatment. Simple tests like nucleated red blood cells could supplement costly tests in resource-limited settings. [6,7]

Recent studies suggest that infants with meconium aspiration syndrome (MAS) have elevated nucleated red blood cell (NRBC) counts, which is a high risk for fetal hypoxia. This study aimed to determine the correlation between NRBC/100WBC counts in cord blood of neonates born with MAS and respiratory symptoms, as counting NRBC in cord blood is less expensive. [7]

AIM AND OBJECTIVES

The study aims to compare the number of NRBC/100WBC in the cord blood of neonates born with meconium-stained amniotic fluid with respiratory symptoms and those born with clear amniotic fluid, as an indicator of respiratory symptoms severity.

MATERIALS AND METHODS

This study enrolled twelve newborns in Krishna Hospital, Karad, with meconium-stained amniotic fluid exhibiting respiratory symptoms, without respiratory symptoms, or with clear amniotic fluid without symptoms, all born in the Department of Obstetrics and Gynaecology, KIMS, Karad.

The study, a hospital-based prospective and critical study, was conducted at Krishna Hospital in Karnataka for 18 months, following ethical guidelines and parental consent.

This study included 36 newborns from June 2022 to November 2023, using a sample size of 12 in each group with 90% confidence interval. The mean and standard deviation of newborns with respiratory symptoms, clear amniotic fluids, and meconium-stained amniotic fluid were calculated.

After delivery, umbilical cord erythrocytes were collected and analyzed for hemoglobin percentage and white blood cell count. Nucleated red blood cell counts were manually determined in a pathology lab.

INCLUSION CRITERIA: The inclusion criteria include term newborn babies (37-41 weeks gestational age), normal birth weight 2.5-3.5kg, and term newborn babies born via elective LSCS or vaginal delivery.

EXCLUSION CRITERIA: The exclusion criteria include mothers with pre-pregnancy or labor-related conditions like diabetes, hypertension, preeclampsia, COPD, smoking, drug or alcohol abuse, plasma dysfunction, chronic conditions, newborns with anomalies, LW babies, and IUGR.

Investigations involved peripheral blood smear, arterial blood pH with serum lactate, reactive protein (CRP), electrophysiological sedimentation rate (ESR), neuronography, and chest X-ray.

RESULTS

Table no 1: Descriptive statistics for Mean Gestational age in Group A, Group B, Group C

		N	Mean	Std. Deviation	Minimum	Maximum
Gestational Age(weeks)	Group A	12	39.2500	.87126	38.00	40.30
	Group B	12	38.8917	.63741	38.10	40.20
	Group C	12	38.9333	.69848	38.00	40.00

The mean gestational age of newborns in three groups was 39.25 ± 0.87 weeks, with Group A having the highest mean gestational age. Group B had the lowest mean gestational age.

Table no:2: Descriptive statistics for Mean birth weight in Group A, Group B, Group C

		N	Mean	Std .Deviation	Minimum	Maximum
Birth weight (KG)	Group A	12	2.8733	.18480	2.60	3.20
	Group B	12	2.9475	.17147	2.70	3.30
	Group C	12	2.8542	.12595	2.60	3.10

The mean birth weight of newborns in three groups was 2.87 ± 0.18 kgs, 2.94 ± 0.17 kgs, and 2.85 ± 0.12 kgs, with Group B having the highest weight and Group C having the lowest.

Table no 3: Descriptive statistics for Mean cord blood hemoglobin in Group A, Group B, Group C

		N	Mean	Std.Deviation	Minimum	Maximum
Hemoglobin (%)	Group A	12	16.48333	1.231284	14.600	18.600
	Group B	12	16.72500	1.454851	14.600	19.200
	Group C	12	15.91667	1.983034	13.600	19.200

Mean haemoglobin levels in newborns were analyzed in three groups: Group A, Group B, and Group C. Group B had the highest levels, while Group C had the lowest.

Table no 4: Descriptive statistics for Mean White blood cell count (WBC) in Group A, Group B, Group C

		N	Mean	Std. Deviation	Minimum	Maximum
WBC count (Cu.mm)	Group A	12	15825.0000	3194.91784	9600.00	21200.00
	Group B	12	15333.3333	3706.58709	8700.00	22400.00
	Group C	12	13095.8333	2390.55512	8300.00	16900.00

The mean white blood cell (WBC) count in three groups was 15825 ± 3.194 /cu mm, with Group A having the highest count. The study involved twelve newborns with meconium-stained amniotic fluid.

Table no 5:Descriptive statistics for Mean NRBC count/100 WBC in Group A, Group B, Group C

		N	Mean	Std. Deviation	Minimum	Maximum
NRBC count/100wbc	Group A	12	13.5833	3.11764	10.00	22.00
	Group B	12	4.6667	3.17185	.00	10.00
	Group C	12	4.5833	2.71221	.00	10.00

The mean NRBC count/100 WBC count distribution in three groups was 13.58±3.11 for Group A, 4.66±3.17 for Group B, and 4.58±2.71 for Group C, with Group A having the highest mean.

Table no 6: Descriptive statistics for Mean erythrocytes edimentation rate (ESR) in Group A, Group B, Group C

		N	Mean	Std. Deviation	Minimum	Maximum
ESR (mm at the end of one hour)	Group A	12	8.3333	3.25669	5.00	15.00
	Group B	12	6.6667	2.46183	5.00	10.00
	Group C	12	5.0000	.00000	5.00	5.00

The mean ESR of newborns in three groups was 8.33±3.25mm at the end of 1 hour, with Group A having the highest ESR and Group C having the lowest.

Table 7:Descriptive statistics for Mean Gestational age, birth weight, haemoglobin, WBC count, NRBC/100 WBC and ESR

		N	Mean	Std. Deviation	Minimum	Maximum
Gestational Age(weeks)	GroupA	12	39.2500	.87126	38.00	40.30
	GroupB	12	38.8917	.63741	38.10	40.20
	GroupC	12	38.9333	.69848	38.00	40.00
Birth weight (KG)	GroupA	12	2.8733	.18480	2.60	3.20
	GroupB	12	2.9475	.17147	2.70	3.30
	GroupC	12	2.8542	.12595	2.60	3.10
Hemoglobin (%)	GroupA	12	16.48333	1.231284	14.600	18.600
	GroupB	12	16.72500	1.454851	14.600	19.200
	GroupC	12	15.91667	1.983034	13.600	19.200
	GroupA	12	15825.0000	3194.91784	9600.00	21200.00

WBC count (Cu.mm)	GroupB	12	15333.3333	3706.58709	8700.00	22400.00
	GroupC	12	13095.8333	2390.55512	8300.00	16900.00
NRBC/100wbc	GroupA	12	13.5833	3.11764	10.00	22.00
	GroupB	12	4.6667	3.17185	.00	10.00
	GroupC	12	4.5833	2.71221	.00	10.00
ESR (mm at the end of one hour)	GroupA	12	8.3333	3.25669	5.00	15.00
	GroupB	12	6.6667	2.46183	5.00	10.00
	GroupC	12	5.0000	.00000	5.00	5.00

Table 8: Intergroup Comparison of Gestational age, birth weight, haemoglobin, WBC count, NRBC count/100wbc and ESR between Group A, Group B and Group C

ANOVA				
			F	Pvalue
GestationalAge(weeks)	Between Groups		.836	.442
Birthweight(kg)	Between Groups		1.101	.344
Hb(%)	Between Groups		.819	.450
WBCcount(cu mm)	Between Groups		2.568	.092
NRBC/100wbc	Between Groups		35.491	.001
ESR(mmat theendof 1hour)	Between Groups		6.000	.006

(*statistical significance at $p < 0.05$ and high statistically significant difference at $p < 0.001$)

The study found no significant differences in gestational age, birthweight, haemoglobin count, WBC count, NRBC count/100 WBC, and ESR between three groups: twelve newborns with meconium-stained amniotic fluid, twelve without respiratory symptoms.

Table 9 : Intra group Comparison of Gestational age, birth weight, haemoglobin, WBC count, NRBC/100 WBC and ESR between Group A, Group B and Group C

Dependent Variable	(I) Groups	(J) Groups	MeanDifference(I-J)	P value
GestationalAge (weeks)	Group A	Group B	.04167	.990
		Group C	-.31667	.554
	Group B	Group A	-.04167	.990
		Group C	-.35833	.472
	Group C	Group A	.31667	.554
		Group B	.35833	.472
Birthweight (kg)	Group A	Group B	-.07417	.511
		Group C	.01917	.955
	Group B	Group A	.07417	.511
		Group C	.09333	.350
	Group C	Group A	-.01917	.955
		Group B	-.09333	.350
Hb(%)	Group A	Group B	-.241667	.926
		Group C	.566667	.660
	Group B	Group A	.241667	.926
		Group C	.808333	.435
	Group C	Group A	-.566667	.660

		Group B	-.808333	.435
WBCcount(cumm)	Group A	Group B	491.66667	.923
		Group C	2729.16667	.100
	Group B	Group A	-491.66667	.923
		Group C	2237.50000	.205
	Group C	Group A	-2729.16667	.100
		Group B	-2237.50000	.205
NRBC/100wbc	Group A	Group B	8.91667*	.001
		Group C	9.00000*	.001
	Group B	Group A	-8.91667*	.001
		Group C	.08333	.997
	Group C	Group A	-9.00000*	.001
		Group B	-.08333	.997
ESR(mmattheendof one hour)	Group A	Group B	1.66667	.209
		Group C	3.33333*	.004
	Group B	Group A	-1.66667	.209
		Group C	1.66667	.209
	Group C	Group A	-3.33333*	.004
		Group B	-1.66667	.209

(*statisticalsignificanceatp<0.05andhighstatisticallysignificantdifferenceat** p<0.001)
Intragroup comparisons using Tukey's posthoc test showed no significant differences in gestational age, Hb%, birth weight, WBC count, NRBC count/100 WBC, ESR, or respiratory symptoms between groups A, B, and C. No significant differences were observed in ESR between groups A and B.

Table10:Mode of delivery of Group A, Group B and Group C

			Groups			Total	P value
			Group A	Group B	Group C		
LSCS	ivo	Count	0	0	2	<0.001**	
		% within Groups	0.0%	0.0%	16.7%		
DCDA twins		Count	0	0	2		
		% within Groups	0.0%	0.0%	16.7%		
Lscsivofetal distress		Count	5	0	0		5
		% within Groups	41.7%	0.0%	0.0%		13.9%
LSCSivo maternal request		Count	0	0	2	2	
		% within Groups	0.0%	0.0%	16.7%	5.6%	

Mode of Delivery		Count	0	3	0	3
		% within Groups				
	Lscsivomsl& fetal distress	Count	5	2	0	7
		% within Groups	41.7%	16.7%	0.0%	19.5%
	Lscsivoprev lscs	Count	1	2	1	4
		% within Groups	8.3%	16.7%	8.3%	11.1%
NVD	Count	1	5	7	13	
	% within Groups	8.3%	41.7%	58.3%	36.1%	
Total	Count	12	12	12	36	
	% within Groups	100.0%	100.0%	100.0%	100.0%	

(*statisticalsignificanceatp<0.05andhighstatisticallysignificantdifferenceat** p<0.001)

The study found a significant difference in delivery methods between groups A, B, and C, with Group A having twelve newborns with meconium-stained amniotic fluid and respiratory symptoms.

The study compared the mode of delivery for newborns in three groups: Group A, Group B, and Group C. Results showed significant differences in delivery methods across the groups. In Group A, 41.7% of newborns were delivered by LSCS due to fetal distress, while in Group B, 25.5% were delivered by normal vaginal delivery, and in Group C, 58.3% were delivered by normal vaginal delivery. Group C had the highest proportion of normal vaginal delivery.

Table 11:Cord blood (qualitative) C-Reactive protein(CRP)of Group A,Group B and Group C neonates

			Groups			Total	Pvalue
			Group A	Group B	Group C		
CRP	Negative	Numberof Newborns	2	8	12	22	<0.001*
		% within Groups	16.7%	66.7%	100.0%	61.1%	
	Positive	Numberof Newborns	10	4	0	14	
		% within Groups	83.3%	33.3%	0.0%	38.9%	
Total		Number of Newborns	12	12	12	36	
		% within Groups	100.0%	100.0%	100.0%	100.0%	

A study found a significant difference in CRP status between groups A, B, and C. Group A had 83.3% positive CRP reports, while Group B had a mix of positive and negative CRP reports. Group C had 100% negative CRP reports, with Group A showing a high rate of positivity.

Table12: Mean cord blood pH findings of Group A, Group B and Group C

	N	Mean	Std. Deviation	Minimum	Maximum
Group A	12	7.1925	.13838	6.90	7.34
Group B	12	7.3633	.06035	7.30	7.46
Group C	12	7.3957	.04152	7.34	7.45

The study reveals that Group A newborns had higher NRBC counts/100 WBC than Group B and Group C, with lower pH values, indicating a higher acidity in their umbilical arterial blood.

Table 13: Intergroup comparison of pH values between Group A, Group B and Group C

ANOVA		
pH		
	F	Pvalue
Between Groups	17.502	<0.001*

(*statistical significance at $p < 0.05$ and high statistically significant difference at $p < 0.001$)

The study found significant differences in umbilical arterial pH values between three groups (Group A, Group B, and Group C), indicating significant variations in mean pH levels.

Table14:Intragroup comparison of umbilical arterial pH values between Group A, group B, and Group C

(I) Groups	(J) Groups	Mean Difference(I-J)	P value
GroupA	GroupB	-.17083*	<0.001**
	GroupC	-.20317*	<0.001**
GroupB	GroupA	.17083*	<0.001**
	GroupC	-.03233	.659
GroupC	GroupA	.20317*	<0.001**
	GroupB	.03233	.659

(*statistical significance at $p < 0.05$ and high statistically significant difference at $p < 0.001$)

The study found significant differences in meanumbilical artery pH values between three groups: Group A, Group B, and Group C, with no significant difference between Groups B and C.

Table15:Mean cord blood Serum lactate(mMol/L)values of Group A, Group B and Group C

	N	Mean	Std. Deviation	Minimum	Maximum
GroupA	12	3.8750	2.15665	.90	7.60
GroupB	12	1.1333	.49604	.40	2.20
GroupC	12	1.0083	.70383	.10	2.20

Serum lactate levels in newborns ranged from 1.5-4.5 mMol/L, with Group A having the highest mean levels (3.87 ± 2.15 mMol/L) and Group C having the lowest (1.00 ± 0.70 mMol/L).

Table16: Intergroup Comparison of Serum lactate values between Group A, Group B and Group C

ANOVA		
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	F	P value
Between Groups	17.524	<0.001**

(*statistical significance at $p < 0.05$ and high statistically significant difference at $p < 0.001$)

The study revealed a statistically significant difference in serum lactate values between Group A, Group B, and Group C, with a p-value of less than 0.001.

Table 17: Intragroup comparison of Serum lactate values between Group A, group B and group C

(I) Groups	(J) Groups	Mean Difference (I-J)	P value
Group A	Group B	2.74167*	<0.001**
	Group C	2.86667*	<0.001**
Group B	Group A	-2.74167*	<0.001**
	Group C	.12500	.972
Group C	Group A	-2.86667*	<0.001**
	Group B	-.12500	.972

(*statistical significance at $p < 0.05$ and high statistically significant difference at $p < 0.001$)

The study found significant differences in serum lactate levels between groups A, B, and C, with no significant difference between groups B and C.

Table 18: NEUROSONOGRAM (NSG) (done on day of life 4) findings Group A, Group B and Group C

		Groups			Total n=36	P value
		Group A	Group B	Group C		
NSG	B/L Choroid plexus cyst	1	0	0	1	0.035*
	% within Groups	8.3%	0.0%	0.0%	2.8%	
	B/L PVF	4	0	0	4	
	% within Groups	33.3%	0.0%	0.0%	11.1%	
	B/L PVF with left choroid plexus cyst	1	0	0	1	
	% within Groups	8.3%	0.0%	0.0%	2.8%	
	GRADE 1 GMH	1	0	0	1	
	% within Groups	8.3%	0.0%	0.0%	2.8%	
	Left choroid plexus cyst	1	1	0	2	
	% within Groups	8.3%	8.3%	0.0%	5.6%	
NORMAL	3	9	12	24		
% within Groups	25.0%	75.0%	100.0%	66.7%		
Right choroid plexus cyst	1	2	0	3		
% within Groups	8.3%	16.7%	0.0%	8.3%		
Total	No of newborns	12	12	12	36	

	% within Groups	100.0%	100.0%	100.0%	100.0%
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(*statistical significance at $p < 0.05$ and high statistically significant difference at $p < 0.001$)

A summary of the terms B/L, PVF, and GMH, which are used to describe the causes of periventricular flutter and germinal matrix hemorrhage.

The study analyzed neurosonogram findings in three groups: Group A (33.3%) had bilateral periventricular flaring, Group B (75%) had normal findings, and Group C (100%) had normal findings. The findings showed significant differences between groups, with Group A having meconium-stained amniotic fluid with respiratory symptoms, Group B having meconium-stained amniotic fluid without symptoms, and Group C having clear amniotic fluid without respiratory symptoms.

Table 19: Chest X-ray (on day of life 1) findings Group A, Group B and Group C

		Groups			Total	P value	
		Group A	Group B	Group C			
Chest Xray	Aspiration pneumonitis	No of newborns	6	0	0	<0.001**	
		% within Groups	50.0%	0.0%	0.0%		16.7%
	Hyperinflation	No of newborns	6	1	0		7
		% within Groups	50.0%	8.3%	.0%		19.4%
	NORMAL	No of newborns	0	11	12		23
		% within Groups	0.0%	91.7%	100.0%		63.9%
Total		No of newborns	12	12	12	36	
		% within Groups	100.0%	100.0%	100.0%	100.0%	

(*statistical significance at $p < 0.05$ and high statistically significant difference at $p < 0.001$)

Table 19 shows chest x-ray findings in three groups: Group A (50%) had Aspiration pneumonitis and Hyperinflation, Group B (11 normal, 1 hyperinflation), and Group C (all normal). Statistically significant differences were observed between groups.

Table 20: Diagnosis of Group A, group B and Group C patients

		Groups			Total	P value
		Group A	Group B	Group C		
TERMwithMSL/AGA/ DISCHARGED	No of newborns	0	12	0	9	<0.001*
	%within Groups	0.0%	100%	0.0%	25.0%	
TERM/AGA/ DISCHARGED	No of newborns	0	0	12	12	
	%within Groups	0.0%	0.0%	100.0%	33.3%	
TERM/AGA/MAS WITH RDS	No of newborns	6	0	0	6	
	%within Groups	50%	0.0%	0.0%	16.7%	
TERM/AGA/MAS WITH RDS SEPTIC SHOCK,DIC,MODS, DEATH	No of newborns	1	0	0	1	
	%within Groups	8.3%	0.0%	0.0%	2.8%	
TERM/AGA/MSL WITH RDS	No of newborns	5	0	0	5	
	%within Groups	41.7%	0.0%	0.0%	13.9%	
Total	No of newborns	12	12	12	36	
	%within Groups	100.0%	100.0%	100.0%	100.0%	

***statistical significance at p<0.05 and high statistically significant difference at** p<0.001**

Meconium aspiration syndrome, meconium stained liquor, Appropriate for gestational age, respiratory distress syndrome, disseminated intravascular coagulation, and multiple organ dysfunction syndrome are all conditions causing meconium poisoning.

The study found that 50% of newborns in Group A had TERM/AGA/MAS with respiratory symptoms, while 41.7% had TERM/AGA/MSL with RDS, with 8.3% experiencing death.

TABLE 21: Outcome in Group A, Group B, Group C

Outcome	GroupA	GroupB	GroupC
Discharge	11	12	12
Death	1	0	0

Group A has a lower discharge rate (92%) compared to Groups B and C, both with 100% discharge rates. Group A has recorded 8% mortality, while Groups B and C have no recorded deaths.

Table 22:Respiratory Support needed in Group A, Group Band Group C

			Groups			Total	P value
			Group A	Group B	Group C		
Respiratory Support	CPAP	No of newborns	7	0	0	7	<0.001**
		%within Groups	58.3%	0.0%	0.0%	19.4%	
	HFNC	No of newborns	4	0	0	4	
		%within Groups	33.3%	0.0%	0.0%	11.1%	
	mechanical ventilation	No of newborns	1	0	0	1	
		%within Groups	8.3%	0.0%	0.0%	2.8%	
	Nil	No of newborns	0	12	12	24	
		%within Groups	0.0%	100.0%	100.0%	66.7%	
	Total	No of newborns	12	12	12	36	
		%within Groups	100.0%	100.0%	100.0%	100.0%	

The study found that 58.3% of newborns required CPAP, 33.3% needed HFNC, and 8.3% needed mechanical ventilation, while no respiratory support was required in Group B and Group C.

Table no 23:Correlation of NRBC counts/100WBC in Group A, B, C with mode of delivery

NRBC counts/100 WBC	LSCS	NVD	Total(n-36)
GROUP A (13.5±3.11)	11(30.5%)	1(2.7%)	12
GROUP B (4.6±3.17)	7(19.4%)	5(13.8%)	12
GROUP C(4.5±2.71)	5(13.8%)	7(19.4%)	12

Group A has the highest mean NRBC counts/100 wbc, with a majority of deliveries via LSCS. Group B and C have moderate and low NRBC counts/100 wbc, with LSCS and NVD deliveries being more evenly split. Group C has the highest proportion of NVD deliveries.

Table no 24:Correlation of NRBC counts/100 WBC in Group A, B, C with type of respiratory support given

NRBC counts/100 wbc	CPAP	HFNC	MECHANICAL VENTILATION	NO SUPPORT	Total(n- 36)
GROUP A (13.5±3.11)	7	4	1	0	12
GROUP B (4.6±3.17)	0	0	0	12	12
GROUP C(4.5±2.71)	0	0	0	12	12

Group A newborns require significant respiratory support, while Groups B and C have lower NRBC counts/100 WBC, and no newborn in these groups requires respiratory support.

Table no 25:Correlation of NRBC counts/100 WBC in Group A,B,C with pH values

NRBC counts/100WBC	pH<7.1	pH7.1-7.29	pH7.3-7.45	Total(n-36)
GROUP A (13.5±3.11)	3	5	4	12
GROUP B (4.6±3.17)	0	0	12	12
GROUP C(4.5±2.71)	0	0	12	12

The study reveals that newborns in Group A had higher NRBC counts/100WBC, resulting in lower pH values, while those in Group B and C had normal pH values.

Table no 26: Correlation of NRBC counts/100 WBC in Group A,B,C with serum lactate levels

NRBCcounts/100 WBC	Serumlactate	Serumlactate	Total(n-36)
	(0-4.5mMol/L)	(>4.5mMol/L)	
GROUP A (13.5±3.11)	7	5	12
GROUP B (4.6±3.17)	12	0	12
GROUP C(4.5±2.71)	12	0	12

Table 26 reveals normal serum lactate levels in Group A, while all newborns have normal levels in Groups B and C. Higher NRBC counts are associated with elevated levels.

Table no 27. Correlation of number of NRBC count/100WBC in Group A with severity of respiratory distress. (Down score)

Group A NRBC count/100 WBC	Mild respiratory distress	Moderate respiratory distress	Severe respiratory distress	Total (n-12)	P VALUE
					<0.001*
10-13	6	0	0	6	
14-18	3	2	0	5	
19-22	0	0	1	1	

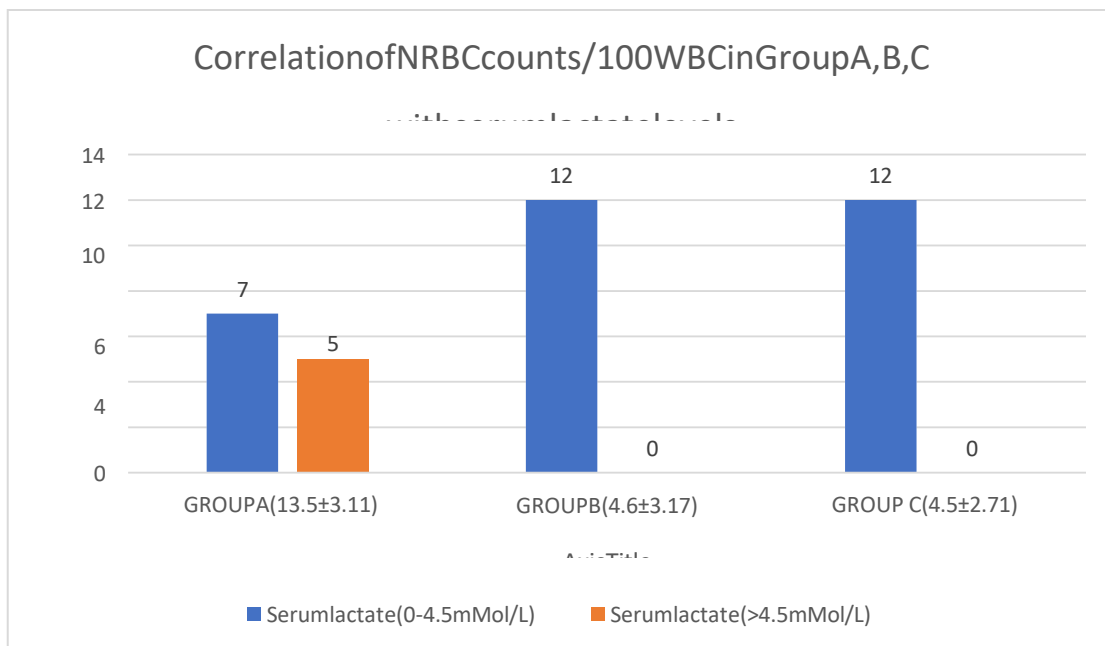


Table 27 show a significant association between NRBC counts and respiratory distress severity, with higher counts indicating a higher severity of respiratory distress, with most mild cases falling within this range.

DISCUSSION

Meconium stained amniotic fluid (MASAF) is more common in term or postterm pregnancies, often resulting from rising motilin levels, normal gastrointestinal function, vagal stimulation, or fetal stress. [8]

Meconium aspiration into the lungs can trigger cardiovascular and inflammatory responses in fetuses and newborns. This leads to chemical pneumonitis, mechanical obstruction of airways, vasospasm, hypertrophy of pulmonary musculature, and pulmonary hypertension. This can result in persistent pulmonary hypertension, contributing to mortality in newborns with MAS. [8]

Meconium aspiration syndrome is prevalent in developing countries, with inadequate antenatal care. Krishna hospital and medical research center in Karad addresses rural population needs. Newborns with respiratory symptoms have higher cord blood NRBC counts.

The study found that newborns with meconium-stained amniotic fluid and respiratory symptoms experienced fetal hypoxia due to an increase in NRBC count/100 WBC. As gestational age increases, the likelihood of MSAF increases due to increased intestinal parasympathetic innervation and myelination, and higher fetal stress, contributing to increased meconium production. [8]

The study found no significant difference in gestational age between Group A, B, and C, similar to a 2001 study by Dollberg et al., which found no significant difference in gestational age between symptomatic and control groups. [7]

Darkhaneh et al's 2008 study found no significant difference in gestational age between study and control groups. However, group A with respiratory symptoms had the highest mean gestational age, indicating an increased risk of MSAF. [9]

The study found no significant difference in birth weights between Group A, Group B, and Group C, consistent with previous studies by Darkhaneh et al., Divya et al., and Dollberg et al. The mean cord blood hemoglobin of newborns in Group A was $16.48 \pm 1.23\%$, $16.72 \pm 1.45\%$, and $15.91 \pm 1.98\%$, respectively. and Marwaha et al., which also found no significant differences in cord blood hemoglobin between the groups. [7,9, 10]

The study found no significant difference in white blood cell (WBC) count between Group A, B, and C, with the highest mean WBC count having higher NRBC count/100 WBC. This finding is consistent with previous studies by Darkhaneh et al. and Dollbergetal. The mean NRBC count/100 WBC for newborns with meconium stained amniotic fluid with respiratory symptoms was higher in Group A, B, and C. The study also found a statistically significant difference in NRBC count/100 WBC between the study and control groups. [7,9]

Dollberg et al.'s 2001 study found that newborns with symptomatic meconium aspiration had higher NRBC count/100 WBC. This is similar to our study. Darkhaneh et al.'s 2008 study found that newborns with meconium stained amniotic fluid had higher NRBC count/100 WBC. The present study found that newborns with meconium stained amniotic fluid with respiratory symptoms had lower pH values and higher NRBC count/100 WBC. [7,9]

Kyoko et al's 2021 study found low cord blood pH (<7.2) associated with MAS in newborns with meconium stained amniotic fluid. This study also found significant differences in cord blood lactate levels and NRBC count/100 WBC between groups, emphasizing the importance of intrauterine inflammation and fetal hypoxia-ischaemia. [11]

Mazouri et al's 2019 study found elevated cord blood lactate levels in newborns with meconium stained amniotic fluid, similar to our study. MAS occurs due to airway obstruction, hypoxia, anaerobic metabolism, and lactate levels. [12]

The study reveals that newborns with meconium stained amniotic fluid have higher CRP positive cases, with higher NRBC count/100 WBC. This is similar to a 2021 study by Kyoko et al., which found high CRP levels at birth were associated with MAS, an inflammation response triggered by meconium, and infection, leading to elevated CRP levels. [11]

The study found that 58.3% of newborns in Group A required continuous positive airway pressure (CPAP), 33.3% needed high flow nasal cannula (HFNC), and 8.3% needed mechanical ventilation, while no respiratory support was required in Group B and Group C. This is significantly different from a previous study that found fewer newborns needed CPAP. [13]

The study found a lower percentage of newborns requiring mechanical ventilation due to a small sample size. The mean NRBC count/100 WBC for normal vaginal delivery and lower segment caesarean section was 4.36 ± 2.59 and 7.19 ± 2.57 respectively. [14]

McCarthy et al's 2006 study found a lower mean NRBC count/100 WBC in relation to normal vaginal delivery and lower segment caesarean section (LSCS), possibly due to differences in indication and location, compared to our study. [15]

The study by Babu et al. in India found a mean NRBC count/100WBC of 4.8 ± 5.17 compared to 6.1 ± 5.5 in the present study. It also found a 33% incidence of respiratory distress in newborns with MAS. [16]

The study compared the percentage of deaths in a 2007 study with a slightly higher incidence of respiratory distress. Newborns with MSAF had significant NSG findings, with 50% having AGA/MAS with RDS/discharged, 41.7% having AGA/MSL with RDS/discharged, and 8.3% having AGA/MSL with RDS, septic shock disseminated intravascular coagulation, multiple organ dysfunction syndrome, and death. [16]

Dollberg et al.'s 2001 study found that 11 neonates had AGA/MAS with RDS, while S.N. Singh et al.'s 2012 study divided 193 newborns with MSAF into two groups: 97 with respiratory distress and 193 with no distress, respectively. [7,17]

The study classified the severity of respiratory distress in MSAF newborns using the Downes score, with mild (75%), moderate (16.6%), and severe (8.3%) newborns. This differs from previous studies, which reported mild (30.9%), moderate (47.4%), and severe (21.6%) severity. [17]

The study by Ravindra nath et al. found that respiratory distress in newborns with MSAF was mild in 72.41%, moderate in 24.13%, and severe in 3.44%. The study found that higher NRBC counts were associated with increased severity of respiratory distress. Chest x-ray findings showed aspiration pneumonitis (50%) and hyperinflation (50%) in newborns with MSAF with respiratory symptoms. [18]

Nikhil et al's 2018 study found similar respiratory symptoms in newborns with MSAF, including hyperinflation, diffuse patchy infiltration, consolidation, collapse, right lung fissure, and pneumothorax. [19]

CONCLUSION

The study found that newborns with MSAF and respiratory symptoms had significantly higher NRBC counts in Group A compared to Group B and Group C. Higher NRBC counts were associated with increased severity of respiratory distress. This suggests that NRBC counts can be used as a marker to evaluate hypoxia in such situations, and can be performed in resource-limited settings for predicting meconium aspiration.

Reference

1. **Shashikala A, Raghavan S. Perinatal Outcome in relation to mode of delivery in MSAF. Indian J Of Pediatrics 1995;62: 63 – 67.**
2. Findlay RD, Tausch HW, Walther FJ. Surfactant replacement therapy for meconium aspiration syndrome. Pediatrics **1996**,97:48-52.
3. Meconium aspiration syndrome: clinical profile, risk factors and outcome in central india .Milind B kamble, Poonam jain . International Journal of contemporary pediatrics .**2019**.

4. Epidemiological factors and clinical profile of meconium aspiration syndrome in newborns admitted in rural tertiary centre. *International journal of contemporary paediatrics*. **2023**.
5. Velaphi S, Vidyasagar D. Intrapartum and post-delivery management of infants born to mothers with MSAF. Evidence based recommendations. *Clin Perinatol* **2006**;33:29-42.
6. Allahyar Jazayeri, Laura Politz. Fetal erythropoietin levels in pregnancies complicated by meconium passage: Does meconium suggest fetal hypoxia? *Am J Obstet Gynecol* **2000**; 183:188-90.
7. Dollberg S, Livny S, Mordecheyev N, Mimouni FB. Nucleated Red Blood Cells in Meconium Aspiration Syndrome. *Obstet Gynecol* **2001**;97:593-6.
8. Meharban Singh. Care of the newborn. 7th Ed. Sagar Publications; **2010**:277-280.
9. Darkhaneh, Asgharnia. Yousefi. Comparison of NRBC in Term Neonatal Umbilical Cord Blood Between Neonate with Meconium stained amniotic fluid (MSAF) and Clear Amniotic Fluid. *J Turkish-German Gynecol Assoc*, **2008**;9(2):00-00
10. N. Marwaha, A. Narang. Routine hematological values in term newborns. *Journal of Indian pediatrics* **2010**
11. Kyoko Yokoi, Osuke iwata. Evidence of both foetal inflammation and hypoxia- ischaemia is associated with meconium aspiration syndrome. *PubMed central*. **2021**
12. Ali mazouri, Maryam saboute. The prognostic value of the level of lactate in umbilical cord blood in predicting complications of neonates with meconium aspiration syndrome. *The journal of maternal- fetal & neonatal medicine*. **2019**.
13. Peter A Dargaville. Respiratory support in meconium aspiration syndrome: A practical guide. *Int J pediatrics*. **2012**.
14. Hanlon-Lundberg KM, Kirby RS, Gandhi S, Broekhuizen FF. Nucleated red blood cells in cord blood of singleton term neonates. *American journal of obstetrics and gynecology*. **1997 Jun 1**;176(6):1149-56.
15. McCarthy JM. Umbilical cord nucleated red blood cell counts. Normal values and the effect of labor. *J Perinatology*. **2006**;26(2): 89-92.
16. Pushpa B, Neelam E. Fetal and neonatal Outcome of babies in meconium stained amniotic fluid and meconium aspiration syndrome. *J of Obstet and Gynecol of India* **2007**;57(6):501-504
17. S.N. Singh, Anita Singh. Respiratory Distress Including Meconium Aspiration Syndrome in Vigorous Neonates Born Through Meconium Stained Amniotic Fluid: Incidence, Onset, Severity and Predictors at Birth. *Indian J pediatrics*. **2013**
18. Ravindra Nath. Study of clinical profile of meconium aspiration syndrome in relation to gestational age and birth weight and their immediate outcome at Narayana Medical College Hospital, Nellore, India. *international journal of contemporary paediatrics*. **2017**.
19. Nikhil Agrawal, Shyam kumar mahato. Clinico-radiological Observations in Meconium Aspiration Syndrome. *journal of Nepal medical association*. **2018**