A STUDY OF NUCLEATED RED BLOOD CELLSIN 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
Meconium, MAS, COPD, vernix

ABSTRACT:
Introduction: Meconium, a fetal secretion containing urine, hair, and vernix, is present in the fetal ileum within 10-16 weeks of gestation. It is the first stools a newborn passes and is the first symptom a newborn passes within 24 hours of birth. Meconium aspiration syndrome (MAS) is a life-threatening respiratory disease affecting some neonates born through meconium-stained amniotic fluid. **Aims:** The study aims to compare the number of NRBC/100WBC in neonates born with meconium-stained amniotic fluid with respiratory symptoms and those with clear amniotic fluid. **Methodology:** The study enrolled twelve newborns at Krishna Hospital, Karad, to compare hematological parameters. The study included term newborns, normal birth weight, and vaginal delivery. Exclusion criteria included pre-existing conditions. **Results:** The study compared gestational age, Hb%, birth weight, WBC count, and ESR between groups A, B, and C. No significant differences were found in NRBC count/100 WBC, ESR, mode of delivery, or respiratory symptoms. **Discussion:** Meconium stained amniotic fluid (MSAF) is a common issue in pregnancies, causing cardiovascular and inflammatory responses, pneumonitis, and pulmonary hypertension. As gestational age increases, the likelihood of developing MSAF increases. **Conclusion:** The study found that newborns with meconium aspiration syndrome and respiratory symptoms had higher neoplastic blood cell (NRBC) counts, indicating increased respiratory distress severity and potential markers of intrauterine hypoxia.

INTRODUCTION

Meconium, derived from the Greek word "meconium-arion," is believed to promote fetal sleep during gestation, derived from the Latin word "menium" meaning poppy juice. [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, characterized by signs like tachypnoea, bradycardia, and hypotonia, is primarily caused by bile salts, with the exact chemicals responsible for the violent inflammatory response. [1]
Meconium aspiration syndrome (MAS) is a life-threatening respiratory disease affecting some neonates born through meconium-stained amniotic fluid (MSAF). [3]
A study in Tamilnadu found a 12.8% incidence of meconium aspiration syndrome among newborns with meconium stained amniotic fluid. [4]
A study at Vasantrao Naik Governmemt Medical College found meconium stained amniotic fluid complicates delivery in 8% to 25% of live births, with 5% 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. [4,5]

Chronic fetal hypoxia leads to increased erythropoiesis due to erythropoietin stimulation, but there is limited information on the hematologic status of infants with meconium aspiration. [6]
Early identification and intervention in newborns with MAS can improve outcomes and avoid costly treatment. Simple tests like nucleated red blood cells could supplement costly tests. [5]
Studies show elevated nucleated red blood cell (NRBC) counts in neonates with meconium aspiration syndrome, indicating fetal hypoxia and respiratory symptoms in pregnancy with meconium staining of amniotic fluid.[6]
The study aimed to determine the correlation between NRBC/100WBC counts in neonates with meconium stained amniotic fluid and respiratory symptoms severity, using a less expensive method.

AIM AND OBJECTIVES

The study aims to compare the number of NRBC/100WBC in neonates born with meconium-stained amniotic fluid with respiratory symptoms and those with clear amniotic fluid.

Methodology

This study enrolled twelve newborns in Krishna Hospital, Karad, with meconium-stained amniotic fluid exhibiting respiratory symptoms, without symptoms, or clear amniotic fluid without symptoms.

STUDY SETTING: Tertiary care hospital (Krishna Hospital, Karad)

TYPE OF STUDY: HOSPITAL-BASED PROSPECTIVE COMPARITIVE STUDY.

STUDY DURATION: 18 months (June 2022-November 2023)

The study involved 36 newborns from June 2022 to November 2023, with informed consent from their parents. The sample size was 12 in each group, with 90% confidence interval. The study aimed to compare hematological parameters among newborns with meconium-stained amniotic fluid and clear amniotic fluid.

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

EXCLUSION CRITERIA: Mothers with pre-existing conditions like diabetes, hypertension, preeclampsia, COPD, smoking, drug or alcohol abuse, placental abruption, chronic conditions, newborns with congenital anomalies, LBW babies, and instrumental delivery.

Investigations involved peripheral smear, arterial blood pH, C reactive protein, ESR, neuronography, and chest x-ray tests from respective departments.

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

Table 1 shows gestational age distribution in three groups: Group A (39.25±0.87 weeks), Group B (38.89±0.63 weeks), and Group C (38.93±0.69 weeks). Group A had the highest gestational age, while Group B had the lowest.

The study analyzed the mean birth weight of twelve newborns in three groups: A, B, and C. The mean birth weight was 2.87±0.18 kgs, 2.94±0.17 kgs, and 2.85±0.12 kgs, respectively. Group B had the highest mean birth weight (2.94±0.17 kgs), while Group C had the lowest (2.85±0.12 kgs). The study also analyzed the distribution of newborns with meconium-stained amniotic fluid with respiratory symptoms, those without respiratory symptoms, and those with clear amniotic fluid without symptoms.

Table no 2: Descriptive statistics for Mean cord blood haemoglobin 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

The mean haemoglobin levels of newborns in three groups were analyzed. Group A had 16.48±1.23%, Group B had 16.72±1.45%, and Group C had 15.91±1.98%. Group B had the highest haemoglobin level, while Group C had the lowest. The study included twelve newborns with meconium-stained amniotic fluid and respiratory symptoms.

The study analyzed the mean white blood cell (WBC) count in twelve newborns with meconium-stained amniotic fluid and respiratory symptoms. The mean WBC count was 15825±3.194/cu mm in Group A, 15333.33±3706.58 /cu mm in Group B, and 13095±2390.555 /cu mm in Group C. Group A had the highest mean WBC count (15825±3.194/cu mm), while Group C had the lowest (13095±2390.555 /cu mm). The study was conducted on twelve newborns with meconium-stained amniotic fluid and respiratory symptoms.

Table no 3: 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. Group A had the highest mean NRBC count/100 WBC, while Group C had the lowest. The study included twelve newborns with meconium-stained amniotic fluid with respiratory symptoms, meconium-stained amniotic fluid without symptoms, and clear amniotic fluid without symptoms.

Table no 4: Descriptive statistics for Mean erythrocyte sedimentation 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 twelve newborns was distributed into three groups: Group A, Group B, and Group C. Group A had the highest mean ESR (8.33±3.25mm at the end of 1 hour), while Group C had the lowest (5. ±00 mm). The study involved twelve newborns with meconium-stained amniotic fluid with respiratory symptoms, those without symptoms, and those with clear amniotic fluid without symptoms.

Table 5: 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)	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
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
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
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
NRBC/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
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 study found no significant difference in gestational age, birthweight, haemoglobin count, and WBC count between three groups: Group A, Group B, and Group C. However, NRBC count/100 WBC and

ESR showed significant differences. The study included twelve newborns with meconium-stained amniotic fluid and respiratory symptoms.

Table 6 : Intragroup 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	Mean Difference (I-J)	P value
Gestational Age (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
Birth weight (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
WBC count (cu mm)	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 (mm at the end of 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

The study compared the intragroup differences in gestational age, Hb%, birth weight, and WBC count between groups A, B, and C using Tukey's post hoc test. No significant differences were found in NRBC count/100 WBC, NRBC count, or ESR between groups. However, there was a significant difference in ESR between groups A and B. The study also compared the meconium-stained amniotic fluid of twelve newborns with respiratory symptoms, those without respiratory symptoms, and those with clear amniotic fluid without respiratory symptoms. No significant differences were observed between groups A, B, and C.

A study comparing the mode of delivery of newborns showed a significant difference between groups A, B, and C. The study involved twelve newborns with meconium-stained amniotic fluid with respiratory symptoms, twelve with meconium-stained amniotic fluid without respiratory symptoms, and twelve with clear amniotic fluid without respiratory symptoms. The mode of delivery for newborns in Group A, Group B, and Group C was evaluated using the chi Square test. In Group A, 41.7% of newborns were delivered by LSCS due to fetal distress and meconium stained liquor, while 8.3% were delivered by normal vaginal delivery and previous LSCS. In Group B, 41.7% were delivered by normal vaginal delivery, 25% by LSCS due to meconium stained liquor, and 16.7% by previous LSCS. In Group C, 58.3% were delivered by normal vaginal delivery, 8.3% by LSCS due to previous LSCS, and 16.7% by LSCS due to dichorionic diamniotic twins.

Table 7: Cord blood (qualitative)C-Reactive protein (CRP) of Group A, GroupB and Group C neonates

			Groups			Total	P value
			Group A	Group B	Group C		
CRP	Negative	Number of Newborns	2	8	12	22	<0.001*
		% within Groups	16.7%	66.7%	100.0%	61.1%	
	Positive	Number of 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 comparing the CRP status of twelve newborns showed a significant difference between groups A, B, and C. Group A had meconium-stained amniotic fluid with respiratory symptoms, while Group B had meconium-stained amniotic fluid without symptoms. Group C had clear amniotic fluid without respiratory symptoms. The distribution of CRP reports showed that Group A had 83.3% of newborns reporting positive CRP, Group B had a mix of CRP status with a higher percentage of negative newborns and 33.3% positive newborns, and Group C had all 12 newborns reporting negative CRP.

Table 8: 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 the mean umbilical arterial cord blood pH in newborns in Group A was 7.19±0.13, compared to 7.36±0.06 and 7.39±0.04, indicating that Group A had higher NRBC counts/100 WBC and lower pH values.

The study found a significant difference in umbilical arterial pH values between three groups, indicating significant variations in mean pH levels, as indicated by an F-value of 17.502 and a P-value less than 0.001.

Table 9: 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
Group A	**Group B**	-.17083*	**<0.001****
	Group C	-.20317*	**<0.001****
Group B	**Group A**	.17083*	**<0.001****
	Group C	-.03233	.659
Group C	**Group A**	.20317*	**<0.001****
	Group B	.03233	.659

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

The study found a significant difference in mean umbilical artery pH values between three groups: Group A, Group B, and Group C, with no significant difference between Group B and Group C.

Table 10: Mean cord blood Serum lactate (mMol/L) values of Group A, Group B and Group C

	N	Mean	Std. Deviation	Minimum	Maximum
Group A	12	3.8750	2.15665	.90	7.60
Group B	12	1.1333	.49604	.40	2.20
Group C	12	1.0083	.70383	.10	2.20

The mean serum lactate levels in three groups were 3.87±2.15 mMol/L for Group A, 1.13±0.49 mMol/L for Group B, and 1.00±0.70 mMol/L for Group C, with normal values in newborns.

Table 11: 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 a significant difference in serum lactate levels between three groups: Group A, Group B, and Group C, with no significant difference between Group B and Group C.

Table 12: 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	No of newborns	1	0	0	1	0.035*
		% within Groups	8.3%	0.0%	0.0%	2.8%	
	B/L PVF	No of newborns	4	0	0	4	
		% within Groups	33.3%	0.0%	0.0%	11.1%	
	B/L PVF with left choroid plexus cyst	No of newborns	1	0	0	1	
		% within Groups	8.3%	0.0%	0.0%	2.8%	
	GRADE 1 GMH	No of newborns	1	0	0	1	
		% within Groups	8.3%	0.0%	0.0%	2.8%	
	Left choroid plexus cyst	No of newborns	1	1	0	2	
		% within Groups	8.3%	8.3%	0.0%	5.6%	
	NORMAL	No of newborns	3	9	12	24	
		% within Groups	25.0%	75.0%	100.0%	66.7%	
	Right choroid plexus cyst	No of newborns	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%	

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

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 a statistically significant difference between the groups. Group A had 12 newborns with meconium-stained amniotic fluid with respiratory symptoms, Group B had 12 newborns with meconium-stained amniotic fluid without symptoms, and Group C had 12 newborns with clear amniotic fluid without symptoms.

Table 13: 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 X ray	Aspiration pneumonitis	No of newborns	6	0	0	6	<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)

The distribution of chest x-ray findings among three groups: Group A, Group B, and Group C. Group A had 50% aspiration pneumonitis and hyperinflation, while Group B had 11 normal newborns and 1 hyperinflation. Group C had all newborns showing normal chest x-rays.

Table 14: Diagnosis of Group A, group B and Group C patients

	Groups			Total	P value
	Group A	Group B	Group C		

TERM with MSL/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

The study analyzed the diagnosis of meconium aspiration syndrome (MAS), meconium stained liquor (MSL), appropriate for gestational age (AGA), respiratory distress syndrome (RDS), disseminated intravascular coagulation (DIC), and multiple organ dysfunction syndrome (MODS) in newborns. The results showed a significant distribution of diagnoses in Group A, Group B, and Group C, with varying degrees of respiratory symptoms.

TABLE 15: Outcome in Group A, Group B, Group C

Outcome	Group A	Group B	Group C
Discharge	11	12	12
Death	1	0	0

The distribution of outcomes in three groups: Group A, Group B, and Group C. Group A has a slightly lower discharge rate (92%) and 8% mortality rate, while Groups B and C have 100% discharge rates and no deaths. The study focuses on twelve newborns with respiratory symptoms.

Table 16: Respiratory Support needed in Group A, Group B and 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 in Group A required CPAP, 33.3% needed HFNC, and 8.3% needed mechanical ventilation, while no respiratory support was required in Group B and Group C. The findings were statistically significant.

The study reveals that Group A has the highest mean NRBC counts/100 wbc, with the majority of deliveries via lower segment Caesarean sections (LSCS). Group B has moderate NRBC counts, with deliveries more evenly split between LSCS and NVD. Group C has the lowest NRBC counts/100 wbc,

with the majority of deliveries being NVD. Group A requires significant respiratory support, while Groups B and C have lower NRBC counts and no newborns require support. Higher NRBC counts are associated with lower pH values, elevated serum lactate levels, and increased severity of respiratory distress. The p-value < 0.001 indicates a highly significant association between NRBC count and respiratory distress severity.

DISCUSSION

Meconium stained amniotic fluid (MSAF) is more common in term or postterm pregnancies, rarely before 34 weeks. It can result from rising motilin levels, normal gastrointestinal function, vagal stimulation, or fetal stress. [7]

Meconium aspiration into the lungs can trigger cardiovascular and inflammatory responses in fetuses and newborns. It can also cause pneumonitis, mechanical obstruction of airways, vasospasm, hypertrophy of pulmonary arterial musculature, and pulmonary hypertension. This can lead to persistent pulmonary hypertension, contributing to mortality in newborns with MAS. [7]

Meconium aspiration syndrome (MSAF) is a prevalent issue in developing countries, particularly in rural areas. A study found that newborns with meconium stained amniotic fluid with respiratory symptoms had higher cord blood NRBC counts/100 WBC than those without respiratory symptoms or those born with clear liquor. This suggests that these newborns may suffer from fetal hypoxia, as the increase in NRBC count/100 WBC is related to hypoxic conditions. The study also found that as gestational age advances, the likelihood of MSAF increases due to increased intestinal parasympathetic innervation and myelination, and higher chances of fetal stress, contributing to increased meconium production and MSAF. [7]

The study found no significant difference in gestational age between Group A, Group B, and Group C, despite having respiratory symptoms. This finding is consistent with previous studies by Dollberg et al. [6](2001) and Darkhaneh et al.[9] (2008). The study found that the group with respiratory symptoms (group A) had the highest mean gestational age, indicating that as gestational age advances, there is a higher likelihood of developing meconium aspiration (MSAF). This suggests that as gestational age increases, there is a higher likelihood of developing MSAF.

The study found no significant difference in birth weights between Group A, Group B, and Group C. This finding is consistent with previous studies by Darkhaneh et al. [9](2008), Divya et al.[10] (2014), and Dollberg et al. [6](2001), which found no significant difference in birth weights between symptomatic meconium aspiration, asymptomatic meconium aspiration, and control groups. The mean birth weight of term newborns in Maharashtra, India, was 3.07±0.45 kg.

The study found no significant difference in cord blood hemoglobin between newborns in Group A, Group B, and Group C. This finding aligns with previous research by Darkhaneh et al.[9] and Marwaha et al.[8], which found no significant difference in hemoglobin between the study and control groups. The mean cord blood hemoglobin in the study was 16.48±1.23%, 16.72±1.45%, and 15.91±1.98%, respectively, which is comparable to previous studies.

The study found no significant difference in white blood cell (WBC) count between Group A, Group B, and Group C. However, Group A had the highest mean WBC count, which was higher than the control group. This finding is consistent with previous studies by Darkhaneh et al. and Dollberg et al. The mean NRBC count/100 WBC was 13.58±3.11 for Group A, 4.66±3.17 for Group B, and 4.58±2.71 for Group C. Newborns with meconium stained amniotic fluid with respiratory symptoms had higher NRBC count/100 WBC, with a statistically significant difference between Group A, B, and C. These findings support previous research on meconium aspiration and NRBC count in newborns. [9,6]

The study by Darkhaneh et al. (2008) found that newborns with meconium stained amniotic fluid (MSAF) had higher NRBC count/100 WBC compared to the control group. This finding is consistent with previous research by Dollberg et al. (2001), who also found similar results. The study also found that newborns with symptomatic meconium aspiration had higher NRBC count/100 WBC.[9]

The study also found that newborns with meconium stained amniotic fluid had higher NRBC count/100 WBC than those with clear amniotic fluid. The mean cord blood pH values for newborns in Group A, Group B, and Group C were significantly different, with newborns with respiratory symptoms having lower pH values and higher NRBC count/100 WBC.

Kyoko et al. (2021) found that low cord blood pH values were associated with MAS in newborns with meconium stained amniotic fluid. These findings emphasize the importance of considering intrauterine inflammation and fetal hypoxia-ischaemia in the mechanism, prediction, and prevention of MAS. [11]

The study also found significant differences in mean serum lactate levels between Group A, Group B, and Group C, with newborns with meconium stained amniotic fluid with respiratory symptoms having higher lactate levels and NRBC count/100 WBC.
Mazouri et al's [12] 2019 study found elevated cord blood lactate levels in newborns with meconium stained amniotic fluid (MAS) and a significant difference between the study and control groups. MAS occurs due to airway obstruction, causing hypoxia and increasing lactate levels in the cord blood. In the present study, newborns with meconium stained amniotic fluid with respiratory symptoms had higher CRP positive cases, with higher NRBC count/100 WBC. High CRP levels at birth were closely associated with MAS in babies with meconium stained amniotic fluid. Meconium can trigger an inflammatory response, leading to pro-inflammatory cytokines and elevated CRP. MAS can also be associated with infection, leading to elevated CRP and systemic stress. In the present study, 58.3% of newborns required CPAP, 33.3% required HFNC, and 8.3% required mechanical ventilation, while no respiratory support was required in Group B and Group C.
The study by Peter et al. [13] found that 20-30% of newborns with mas required CPAP, with up to 25% requiring intubation. The percentage of CPAP required in newborns was lower in the present study due to a small sample size. The mean NRBC count/100 WBC in relation to normal vaginal delivery and lower segment caesarean section (LSCS) was lower in the present study compared to previous studies. This difference may be due to differences in indication of LSCS and the study's location in rural areas. The study also found comparable observations in a study by Babu et al. in India in 2012, which found mean NRBC count/100 WBC in relation to normal vaginal delivery and lower segment caesarean section.
The study found that 33% of newborns with MAS had respiratory distress and 2.77% died. This is slightly higher than the 2007 study by Pushpa et al [14], which had 13.4% and 2% deaths. The study also conducted Neural Stimulation (NSG) in three groups, revealing significant NSG findings in newborns with MSAF with or without respiratory symptoms. In Group A, 50% had AGA/MAS with RDS/discharged, 41.7% had AGA/MSL with RDS/discharged, and 8.3% had AGA/MSL with RDS, septic shock disseminated intravascular coagulation, multiple organ dysfunction syndrome, and death. In Group B, 100% had MSL/AGA/discharged, and in Group C, 100% had AGA/discharged. The study also found that 97 newborns with MSAF had respiratory distress, while 193 had no respiratory distress. The incidence of respiratory distress was slightly higher in the current study.
The study categorized the severity of respiratory distress in newborns with MSAF using the Downes score. The severity was found to be mild in 9 (75%), moderate in 2 (16.6%), and severe in 1 (8.3%). This finding is consistent with previous studies by S.N. Singh et al.[15] and Ravindra Nath et al.[16], which found mildness in 30 (30.9%), moderate in 46 (47.4%), and severe in 21 (21.6%). The study also found a trend where higher NRBC counts were associated with increased severity of respiratory distress. The chest x-ray findings of newborns with MSAF with respiratory symptoms showed aspiration pneumonitis (50%), hyperinflation (50%), diffuse patchy infiltration (37%), consolidation (21.7%), collapse (8.7%), right lung fissure (6.5%), and pneumothorax (8.7%). These findings are similar to the current study.

CONCLUSION

The study found that newborns born with meconium aspiration syndrome (MSAF) and respiratory symptoms had significantly higher neoplastic blood cells (NRBC) counts than those in other groups. The mean NRBC count in Group A was 13.58±3.11, which is significantly higher than in Groups B and C. This indicates that higher NRBC counts are associated with increased severity of respiratory distress. The study also aimed to determine markers of intrauterine hypoxia, a major contributor to adverse neonatal outcomes. Meconium Aspiration Syndrome is a common cause of morbidity and mortality in newborns, especially in rural areas. The study concluded that NRBC counts in Group A newborns are statistically significant compared to Groups B and C, and can be used as a marker to evaluate hypoxia in such situations. This simple laboratory test is cost-effective and can be performed in resource-limited settings.

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