e-ISSN: 0975-5160, p-ISSN: 2820-2651

Available online on www.ijtpr.com

International Journal of Toxicological and Pharmacological Research 2023; 13(3); 43-55

Original Research Article

A Study of Neonatal Outcomes and Risk Factors in Neonates Born with Meconium Stained Amniotic Fluid

Satyapal Singh[1], Anurag Jain[2], Jyoti Prajapati[3], Sunil Arya[4], Preeti Gupta[5], Mahesh Gupta[6]

[1]Senior Resident, Dept. of Pediatrics, GMC Datia, M.P., India
[2]Associate Professor, Dept. of Surgery, GMC Ratlam, M.P., India
[3]Assistant Professor, Dept. of Pediatrics, MGM Medical College, Indore, M.P., India
[4]Associate Professor, Dept. of Pediatrics, MGM Medical College, Indore, M.P., India
[5]PGMO, Dept. of Ophthalmology, District Hospital Ratlam, M.P., India
[6]Assistant Professor, Dept. of Community Medicine, GMC Ratlam, M.P., India

Received: 30-01-2023 / Revised: 18-01-2023 / Accepted: 10-02-2023
Corresponding author: Dr Mahesh Gupta
Conflict of interest: Nil

Abstract

Background: Meconium stained amniotic fluid (MSAF) is a commonly observed phenomenon in routine Obstetric and Pediatric practice, which is considered as one of the signs of fetal distress in cases other than breech presentation.Factors such as placental insufficiency, maternal hypertension, pre-eclampsia, oligohydroamnios, chorioamnionitis, IUGR or maternal drug abuse (tobacco or cocaine) result in utero passage of Meconium. Meconium Aspiration Syndrome (MAS) remains as the commonest causes of respiratory distress in term & post term infants. It is a life-threatening respiratory emergency. Thus, it needs an early intervention by recognising the early signs and symptoms. In recognition of same this study was undertakento determine the maternal factors and neonatal outcome of pregnancy complicated by meconium stained amniotic fluid.

Aim and Object: The Primary objective Was estimation of the prevalence of neonates born with MSAF and to know outcome of neonates born with MSAF. Secondary Objective was to determine the risk factors associated with increased morbidity and mortality among admitted neonates born with MSA.

Methods: The present Prospective Observational study was undertaken on a total of 225 eligible neonates born with MSAF and qualifying the inclusion criteria in MYH Hospital, Indore (M.P.) for a period of 1 year. 225 live births with MSAF were included and their outcomes were noted in terms of morbidity and mortality.

Results: Overall incidence of MSAF was 12% in the present study. Risk factors encountered were maternal age < 25 years, anemia, pre-eclampsia, PROM, and primi-gravida. LSCS was the most common delivery modality. 861 (79.28%) vigorous babies needed no active intervention at birth and shifted to mother side while 225 (20.72%) developed MAS and needed active intervention at births and were admitted in NICU. Overall neonatal mortality was 11.6%. Downe's Score at admission and APGAR Score at 1 & 5 min were significantly correlated with MAS in our study.

Conclusions: The presence of MSAF at delivery is a potential sign of fetal compromise. Alerting the paediatrician and proper resuscitation of babies born through MSAF reduces the overall morbidity and mortality.

Keywords: MSAF, MAS, Pre-Eclampsia, Meconium Aspiration Syndrome, Birth Asphyxia.

Introduction

Meconium-stained amniotic fluid has long been known to impact foetal health during the intrapartum and postpartum periods. Aristotle, the famous ancient Greek philosopher was the first to describemeconium stained amniotic fluid, conferring on this condition the name "meconium-arion" which literally means "opium-like". Meconium being the first intestinal secretion from the foetus starts as early as 10 weeks of gestation [1] and tends to increase in its incidence with increasing Period of gestation (POG). Meconium stained amniotic fluid (MSAF) is a commonly observed phenomenon in routine Obstetric and Pediatric practice, which is considered as oneof the signs of fetal distress in cases other than breech presentation. However, thereis controversy regarding its relative importance compared to other factors as an indicator of fetal distress such as - decrease in fetal scalp blood pH, variations in fetal heart rate (FHR) pattern, non-reactive Cardiotocography (CTG) [2] and loss of fetal movements or decreased fetal movements.

MSAF is usually considered as a response from the baby when there is a temporarily reduced oxygen supply at some point of time (usually during labour) or a slowly reducing level of oxygen over a period of time. Factors such as placental insufficiency, maternal hypertension, pre-eclampsia, oligohydroamnios, chorioamnionitis, IUGR or maternal drug abuse (tobacco or cocaine) result in utero passage of Meconium.

The overall frequency of Meconium stained amniotic fluid (MSAF) varies between 10% to 25% is common in Full Terms and especially in post-dated deliveries. Approximately 10% to 30% of the neonates born through MSAF develop meconium aspiration syndrome (MAS) and 30% to 50% of these infants require continuous positive airway pressure (CPAP) or mechanical ventilation. Themortality rate of meconium stained neonate is considerably higher than that of non-stained neonates [3].

Meconium Aspiration Syndrome (MAS) remains as the most commonest causes of respiratory distress in term & post term infants. It is a life threatening respiratory emergency. Despite adequate management, there is a high risk of morbidity in the form of seizures, cerebral palsy, mental retardation, respiratory problems of childhood & mortality [4]. The clinical syndrome includes respiratory distress with cyanosis in room air and/ or aspiration pneumonia or/and pneumothorax and in severe cases it is accompanied by pulmonary hypertension. Thorough suctioning of the nose, mouth and posterior pharynx before delivery of the shoulders and thorax appears to decrease the risk of MAS.

Nevertheless, a significant [26-30%] number of neonates will have meconium in the trachea despite such suctioning and in the absence of spontaneous respirations. Thus, it suggests the need for tracheal suctioning after delivery [5]. Meconium passage is a developmentally programmed postnatal event because 98% of healthy newborns pass meconium in the first 24 to 48 hours after birth.6 Treatment of MAS is a challenge to neonatologists. Appropriate use of positive end expiratory pressure, surfactant therapy, recent advances like high frequency ventilation and inhaled nitric oxide have led to reduced incidence of adverse outcome and improved survival rate of newborns with MAS.

Various anecdotal studies[6] have described the various attributes and morbidity pattern of MAS. But there is still a paucity of studies which identifies the potential maternal factors

contributing to Meconium in foetus. In recognition of same this study was undertaken to determine the maternal factors and neonatal outcome of pregnancy complicated by meconium stained amniotic fluid. In developing countries like INDIA, where most peripheral centres lack facilities for managing high risk deliveries and giving essential newborn care, the role of anticipation and timely referral have great importance. Therefore, identification of maternal factors may help to anticipate the need for neonatal resuscitation in delivery room which eventually helps to improve the perinatal outcome and reduce perinatal mortality and morbidity associated with MSAF.

Objective

1. To estimate and know the incidence and outcome of neonates born with MSAF.
2. To determine the risk factors associated with increased morbidity and mortality among admitted neonates born with MSA.

Material and Methods

This present prospective observational study was undertaken with 225 eligible neonates born with MSAF in Maharaja Yashwant Rao Hospital (M.Y.H), Department of Pediatrics, MGM Medical College Indore (M.P.). The study was conducted over a period of 1 year after clearance from institutional and university ethical committee. A written informed consent was obtained from the parents of the subjects included before enrolling in study.

Inclusion criteria

1. All meconium stained live births born in MY hospital.

Exclusion criteria

1. Parent refusal to participate in the study.
2. Major congenital malformations(like congenital diaphragmatic hernia, congenital heart diseases, brain or kidney anomalies).

Method

After taking a pre-informed written consent from the parents of the neonates born with MSAF, a predesigned structured proforma was used to collect the baseline data. 225 neonates born with MSAF in MYH Hospital, Indore were enrolled for the study. Maternal data was collected from M.Y.H Labour rooms records.The neonates who fulfilled the inclusion criteria and whose parents were willing to give consent were enrolled in the study.

Detailed mother's history, risk factors, progress of labour, meconium staining of amniotic fluid and mode of delivery were noted. Evaluation and decisions regarding resuscitation measures were guided by assessment of respiration, heart rate, and color and tone of the baby. Apgar scores were conventionally assigned and recorded in the newborn's chart. If any meconium staining was present, suctioning of the mouth and nostrils was done immediately after delivery. If the infant was depressed with poor muscle tone and/or a heart rate <100 beats/min, tracheal intubation and suctioning was performed. If the infant was vigorous then routine care was given. non-asphyxiated and had no abnormal findings were shifted to mother side in the maternity ward. These babies were observed for the development of respiratory distress or signs of sepsis over the next 72 hours and were shifted to NICU if they developed any.

Clinical details of neonates admitted in NICU was recorded in a predesigned proforma and neonates were followed for clinical outcome till discharge from NICU. Neonatal outcome was assessed for:

1. Development of MAS.
2. Incidence of Birth Asphyxia.
3. Incidence of Sepsis.
4. Need for mechanical ventilation.
5. Incidence of PPHN.
6. Pneumothorax and other complications.
7. Mortality.

Statistical Analysis

The data was coded and entered into Microsoft excel 2010 (Microsoft corp.) and was analysed using excel 2010 and Epi-info. Continuous data was expressed in terms of Mean and SD and Categorical data was expressed in the form of proportions and percentage. Appropriate test of significance like ttest and chi –square test was applied wherever necessary and p value<0.05 was considered as statistically significant

Result

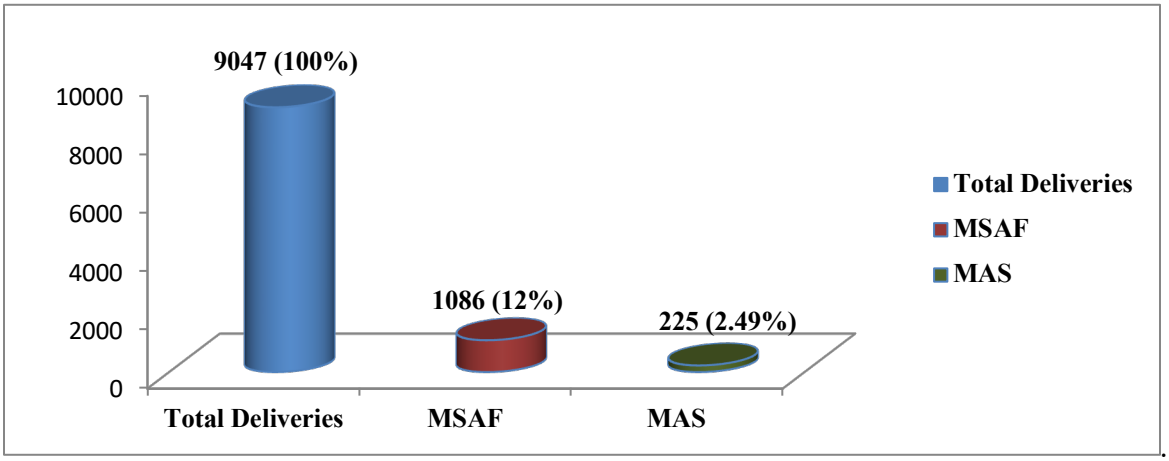

Figure 1: Incidence of MSAF & MAS

Above figure depicted, total of 9047 deliveries were conducted during study period of one year. The overall incidence of MSAF was 12%(1086).Out of 1086 MSAF deliveries,861 (79.28%) vigorous babies needed no active intervention at birth and shifted to mother side while 225(20.72%) developed MAS and needed active intervention at births and were admitted in NICU.

Table 1: Mode of delivery in relation to MSAF Neonate Developed MAS

Mode of delivery	Total no. of deliveries	MSAF No.(%)	MAS No.(%)
AVD	844(9.32%)	130 (15.40%)	21 (2.48%)
LSCS	3567(39.43%)	641 (17.97%)	109(3.06%)
NVD	4636(51.25%)	315 (6.79%)	95 (2.05%)
Total	9047	1086 (12%)	225(2.48%)

Above table depicted, 641(17.97%) MSAF neonates were born via LSCS (total deliveries: 3567 i.e., 39.43%) out of which 109 (3.06%) developed MAS

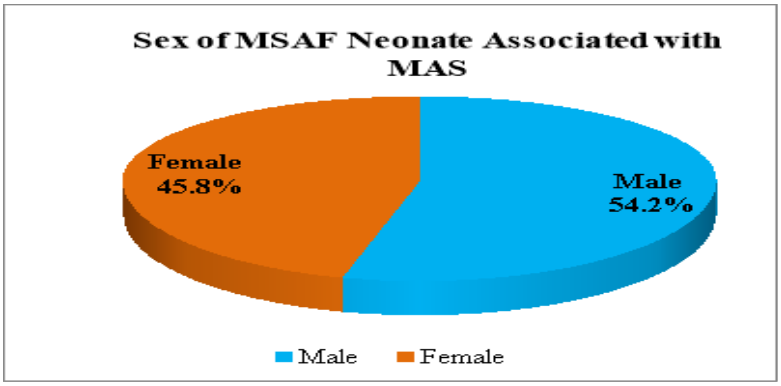

Figure 2: Sex of MSAF Neonate Associated with MAS(N=225)

Above figure depicted, out of total 225 neonates who developed MAS booked deliveries with meconium stained amniotic fluid 122 (54.2%) cases were males and 10345.8% cases were females

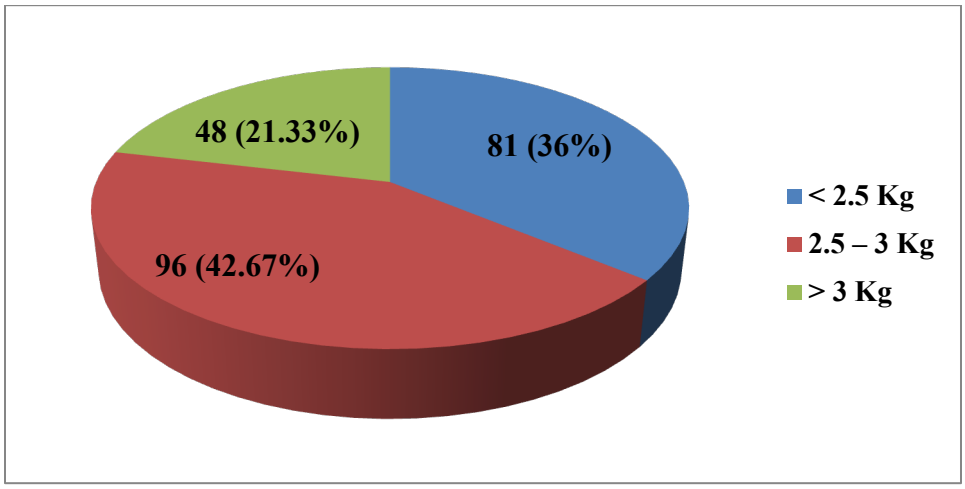

Figure 3: Birth weight of neonates with MAS

Above figure depicted, most of the babies with MSAF had birth weight between 2.5-3 kg (96,42.7%) followed by 81(36%) who had birth weight less than 2.5kg. 48 (21.3%) MSAF neonates who developed MAS were weighted more than 3 kg at birth

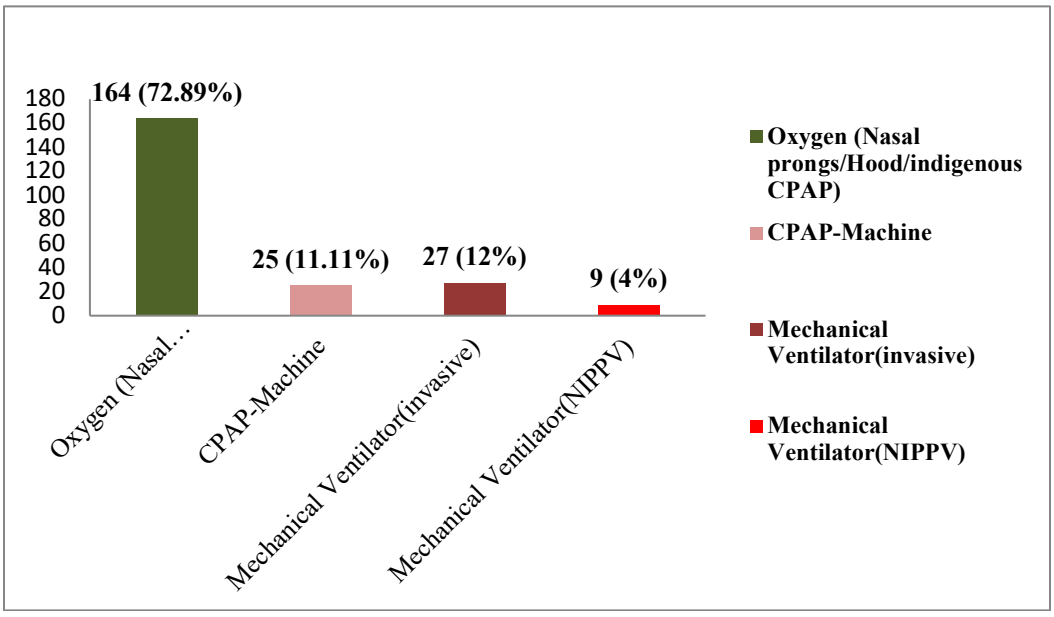

Figure 4: Immediate intervention post-delivery to Neonates with MSAF admitted in NICU (MAS- 225)

Above figure depicted, out of 225 neonates who developed MAS, maximum number 164 (72.9%) of MSAF admitted neonates required O2 via (NP/HOOD/Indigenous CPAP) followed by 27(12%) and 25(11.1%) of MSAF admitted neonates required Mechanical Ventilator (invasive) and CPAP-Machine respectively while only 9 (4%) of MSAF admitted Neonates required Mechanical Ventilator (NIPPV).641(17.97%).

Table 2: Maternal risk factors associated with MAS

S. N.	Maternal Risk Factors		MAS (N=225)				
			Mild	Moderate	Severe	Total	
1.	Gestational Age Group	< 37 week	8 (5.63%)	4 (8.51%)	3 (8.33%)	15 (6.7%)	X^2 =21.648 P = 0.00023* (< 0.05)
		37-40 week	24 (16.90%)	5 (10.63%)	7 (19.44%)	36 (16.0%)	
		>40 week	110 (77.46%)	38 (80.85%)	26 (72.23%)	174 (77.3%)	
		Total	142(100%)	47(100%)	36(100%)	225(100%)	
2.	Maternal Age Group	18-24 Yrs.	83 (58.45%)	27(57.44%)	7(19.44%)	117(52%)	X^2 = 1.99 P = 0.736
		25-32 Yrs.	47 (33.10%)	16(34.04%)	19(52.77%)	82(36.4%)	
		>32 Yrs.	12 (8.45%)	4 (8.51%)	10(27.77%)	26(11.6%)	
		TOTAL	142 (100%)	47(100%)	36(100%)	225(100%)	
3.	Parity	Primi	67 (47.18%)	30 (63.83%)	27 (75%)	124 (55.11%)	X^2 = 10.80 P = 0.0044 (< 0.05)*
		Multi	75 (52.82%)	17 (36.17%)	9 (25%)	101 (44.89%)	
		Total	142 (100%)	47 (100%)	36 (100%)	225 (100%)	
4.	Course of labour	Obstructed	15 (10.6%)	22(46.8%)	19(52.8%)	56(24.9%)	X^2 = 47.860 P < 0.00001 (< 0.05)*
		Prolonged 2nd stage	50 (35.2%)	15 (31.9%)	11 (30.6%)	76 (33.8%)	
		Uneventful	77 (54.2%)	10(21.3%)	6(16.7%)	93(41.3%)	
		Total	142 (100%)	47(100%)	36(100%)	225(100%)	
5.	Anemia		64 (45.05%)	29 (61.70%)	24 (66.67%)	117 (52%)	P value = 0.022*
6.	GDM		3 (2.1%)	1 (2.1%)	6 (16.7%)	10 (4.4%)	P value= 0.0005*
7.	PIH		16 (11.3%)	10 (21.3%)	5 (1.9%)	31 (13.8%)	P value= 0.22
8.	Pre-Eclampsia /Eclampsia		18 (12.7%)	11 (23.4%)	8 (22.2%)	37 (16.4%)	P value= 0.135
9.	Foul Smelling Liquor		5 (3.5%)	5 (10.6%)	4 (11.1%)	14 (6.2%)	P value =0.083
10.	PROM		23 (16.2%)	18 (38.3%)	14 (38.9%)	55 (24.4%)	P value= 0.0008*
11.	Oligohydroamnios		14 (9.9%)	5 (10.6%)	6 (16.7%)	25 (11.1%)	P value= 0.506
12.	Polyhydroamnios		4 (2.8%)	3 (6.4%)	3 (8.3%)	10 (4.4%)	P value= 0.274

Above table depicted, MAS significantly associated with gestational age of neonate at birth, most of neonates with MAS [174 (77.3%)] born post-term and only 15(6.7%) neonates born premature. 117 (52%) MSAF neonates out of 225 had mothers belonging to 18-24 years of age group followed by 82(36.4%) and 26(11.6%) in the 25-32 and >32 years of age group respectively. There were significant association of MAS and parity of mothers, most of the neonates(55.11%) with MAS,

born to mothers were primi-para. Severe MAS more common in obstructed [56 (24.9%)] and prolonged 2nd stage [76 (33.8%)] of labour. It was found that maternal disease further complicated the prevalence and severity of MAS. 115 mothers (51.1%) had other pre-existing anemia while 55 (24.4%) had PROM. Mild, Moderate and Severe MAS more commonly seen in Anemia, GDM, PROM mothers.

Table 3: Downe's score at admission with MAS

Downe's score at admission	MAS			Total
	Mild	Moderate	Severe	
<4	140- 98.6%	18-38.3%	5-13.9%	163-72.4%
5-6	2 -1.4%	29-61.7%	30-83.3%	61-27.1%
>7	0 -0.0%	0-0.0%	1-2.8%	1-0.4%
Total	142-100.0%	47-100.0%	36-100.0%	225-100.0%

It was observed that Downe's Score at admission with MAS was significantly correlated ($p<0.05$) in our study 163(72.4%) neonates belonged to Grade <4 followed by 61(27.1%) neonates who were graded between 5-6. Only 1 neonate out of 225 MAS neonates had a Downe's Score >7.

Table 4: Comparison of APGAR Score at 1 and 5 min in MAS neonates

		N	Mean	Std. Deviation	F value	P value	Post Hoc Tukey Test		
							Mild – Moderate	Mid-Severe	Moderate – Severe
1 Min.	Mild	142	5.87	0.901	53.271	0.00	0.00	0.00	0.002
	Moderate	47	4.83	1.167					
	Severe	36	4.06	1.241					
	Total	225	5.36	1.235					
5 Min.	Mild	142	8.11	0.905	49.898	0.00	0.000	0.00	0.000
	Moderate	47	7.13	1.329					
	Severe	36	6.19	1.369					
	Total	225	7.60	1.303					

Above table depicted, APGAR Score at 1 min and 5 min was significantly correlated ($p<0.05$) with MAS. Maximum number of neonates i.e., 175 (77.8%) belonged to APGAR score of 4-6 al 1 minute while 28 (12.4%) neonates scored 0-3 and 22 (9.8%) neonates had APGAR score between 7-10 at 1 minute. While for APGAR score at 5 minutes, maximum number of neonates i.e., 180 (80%) belonged to 7-10 APGAR Score followed by 42 (18.7%) neonates who scored between 4-6. Only 3 (1.3%) neonates had APGAR SCORE between 0-3 at 5 minute.

Table 5: Outcome of neonates admitted with MAS

During admission in SNCU (N= 225)			
S. No.	Neonatal outcomes	No.	%
1.	Birth Asphyxia –Hypoxic Ischemic Encephalopathy (HIE)	51	22.66%
2.	Mild MAS	142	63.11%
3.	Moderate MAS	47	20.88%
4.	Severe MAS	36	16%
5.	Persistent Pulmonary Hypertension of Newborn (PPHN)	28	12.44%
6.	Shock	40	17.77%
7.	Sepsis (blood culture / sepsis screen)	15+34=49	21.77%
8.	Pulmonary complications (pul.haemorhage /pneumothorax)	18+5=23	10.22%

Final neonatal outcomes after shifting to NICU (N=225)				
9.	Death		26	11.6%
10.	Discharge [N=187 (83.11%)]	Normal	179	79.6%
		Neurologically abnormal at discharge	8	3.5%
11.	Leave Against Medical Advice (LAMA)		12	5.3%
Total			225	100%

Above table depicted, out of 1086 neonates who were born with MSAF, 225 developed MAS and admitted in SNCU. 142(63.11%) developed Mild MAS while 47(20.88%) developed Moderate MAS and only 36(16%) developed Severe MAS. 51(22.00%), 28(12.44%), 40 (17.77%), 49(21.77%) and 23(10.22%) had birth Asphyxia, PPHN, Shock, Sepsis and Pulmonary complications respectively. Out of 225 MSAF neonates who developed MAS and admitted in NICU, 187(83.11%) were discharged from NICU with 179(79.6%) Normal neonates while 7(3.1%) were neurologically abnormal at time of discharge. 26(11.6%) MSAF neonates who developed MAS and admitted in NICU died while 12(5.3%) Neonates leave against medical advice (LAMA).

Discussion

MSAF is frequently seen as a challenge in Pediatrics and Obstetrics. It occurs in 9–20% of deliveries. MSAF has been implicated as a factor influencing fetal wellbeing during the intrapartum and postpartum periods. Its importance is judged by the NRP guidelines which stresses on colour of liquor (clear or meconium stained) as one of the parameters in initial assessment of newborn. Meconium passage into amniotic fluid may be an antepartum or intrapartum event. Presence of MSAF may be a sign of fetal compromise, which is associated with an increase in perinatal morbidity and mortality, whereas clear amniotic fluid, on the other hand, is considered reassuring. MSAF is associated with poor perinatal outcome including low Apgar scores, increased rate of chorioamnionitis and increased incidence of NICU admission and high rate of perinatal death.

Various anecdotal studies have described the various attributes and morbidity pattern of MAS. Incidence of MSAF in labour widely varies as reported from time to time by different studies. In our study, (Fig.1) an incidence of 12% was observed i.e., 1086 out of 9047 deliveries which had meconium stained liquor. 861 (79.28%) vigorous babies needed no active intervention at birth and were shifted to mother side while 225(20.72%) developed MAS and needed active intervention at births and were admitted in NICU. In the largest study available to date, Wiswell *et al*. reported of 176,000 neonates born from 1973 to 1987 in military medical hospitals, during this period of 15 years, there were 4-9 per 1000 live births of MAS neonates and between 3– 8% of neonates who had meconium-stained amniotic fluid [7]. In more recent studies by Kamala G etal (9.37%), Goud & Krishna (9.80%), Rossi *et al* (22%) and Harikumar S (11.20) the overall frequency of MSAF has ranged from 5 to 24.6% (median 14%) of all deliveries [8-11]. As it predicts adverse perinatal outcome even in relatively low risk pregnancies MSAF can be treated as an independent marker of fetal distress.

A higher incidence of MSAF neonates developing MAS was seen in our study with Males i.e., 122 (52.22%) as compared to females i.e., 103 (45.8%) (Fig.2); Male to female ratio: 1.18:1.

Meconium staining in amniotic fluid increases with gestational age. This can be explained by that the hormone ‘motilin’ is secreted in increasing quantities by the fetus as gestational age advances and most meconium discharges

are said to occur in post-dated gestations because the motilin levels are highest [12]. Gupta *et al* [13]. in his study, observed that the highest incidence of MSAF was in post-term babies (55%) and lowest in premature babies (7.8%). In our study, highest incidence of MAS occurred in babies who were born post-term [174(77.3%)] while only6.7% babies born premature presented with meconium staining syndrome. Mean gestational age was around 39 weeks in the present study, which was comparable with the study conducted by Miller *et al*. having mean gestation age of 39.82 weeks [14]. Rosario in his study found mean gestational age of 39.62 weeks [15] and Krebs found mean gestational age of 40.04 weeks indicating gestational age progresses towards post- datism incidence of meconium staining is high [16]. Various other studies conducted by Naveen S *et al*., Sedaghatian *et al*., Oyelese *et al*., Gupta V *et al*., Sandhu S K *et al*., Osava *et al*. and Zhu *et al*. also showed similar results [17-22]. This further confirms that passage of meconium in the mature fetus is facilitated by myelination of nerve fibres and increase in parasympathetic tone and increase in the concentration of motilin [11]. Passage of meconium may occur naturally in a term or post-term fetus with a mature GI tract without fetal distress. It may also be caused by spontaneous intestinal motility or bowel stimulation caused by infection or hypoxia. In women with MSAF as gestational age increases the risk of meconium aspiration syndrome also increases. The increased incidence of meconium-stained amniotic fluid with advancing gestational age probably reflects the maturation of peristalsis in the fetal intestine. Thus, it isn′t just the presence of meconium in prolonged pregnancies, but potentially other factors associated with prolonged pregnancies contribute to MSAF.

In the current study, Maternal age (Table 2) was found to be significantly related with the MAS in our study.When maternal age was considered, incidence of MSAF was more in mothers < 25 years and hence the incidence of MSAF is high in this age group. Similar study by Bharati *et al*. showed an incidence of 74.3% in the age group 20-25 years [23]. The results of our study were also in concurrence with study done by Kamala Ghokroo & Sandu SS *et al*. who showed a prevalence of 56% and 80% respectively in age group of 20-25 years [8,20]. Studies by Vaghela HP *et al*., Neke Akhtar *et al*., Rajlaxmi *et al*. and Unnisa *et al*. also showed similar results [24-27].

Further, higher incidence of MAS (Table 2), in our study, was seen in primipara (124/ 55.1%) than Multiparia (101, 44.9%).The result was statistically significant (p=0.004) indicating an association between meconium staining of liquor and parity of the mother. Similar results were also obtained in studies done by Kamala Ghokroo *et al*., Osava *et al*., Becker *et al*., Urvashi Sharma *et al*. and Narang A *et al* [8,21,28-30].

We observed that most of the babies with MSAF had birth weight between 2.5-3 kg (42.7%) and were more prone to develop MAS. Mundhra *et al*. and Sedaghatian *et al*. and observed similar results in their studies [12,18].

Hypertensive disorders are one of the common maternal medical conditions associated with pregnancy. Association of PIH with MSAF is caused by an underlying utero-placental insufficiency, which causes fetal hypoxia, resulting in meconium passage. In the present study, the most encountered was Anemia (51.1%) followed by PROM (24.4%), Preeclamsia (16.4%), PIH (13.8%), Olighydroamnios (11.1%), Polyhydroamnios and GDM (4.4%). Mild, Moderate and Severe MAS more commonly seen in Anemia, PROM, Preeclamptic, PIH and Olighydroamnios mothers.

In a study done by Vora *et al*. in 2014, 50% cases had maternal risk factors [31]. Our study is in co-relation with Vaghela *et al*. in which, 59% meconium stained cases were associated with maternal risk factors mainly pre-eclampsia and PROM [24]. The results of our

study were comparable with Kamala *et al*. and Bhide SS *et al*. which showed similar incidence of PIH [8,32]. while in contrast with Kamala *et al*., Bhide SS *et al*. and Vinaya Pendse *et al*. for incidence of Anemia [8,32,33].

In the present study an increased incidence of operative delivery(Table1) was observed. Maximum number of MSAF neonates 641(17.97%) were born via LSCS (total deliveries: 3567 i.e., 39.43%) out of which 109 (3.06%) developed MAS. The results of our study were comparable to study done by Goud *et al*., Bhide SS *et al*., A Hadar *et al*., Rajlaxmi *et al*. and Osava *et al*. where LSCS indication was higher [9,32-36]. There was increased incidence of LSCS with meconium stained amniotic fluid as trial of labour was shortened due to fetal distress. Further, when facilities like electronic monitoring, foetal blood sampling are not available, it is difficult to decide whether labour should be allowed to continue or caesarean section should be done. Thus, leading to increased incidence of LSCS as a safer choice. In contrast to our study, Wong *et al*. found that only 13.2% of MSAF underwent LSCS [37]. Such lower rate of LSCS could be due to incorporation of scalp pH sampling in their study unlike ours.

In the present study, there was a significant correlation between Apgar score at 1 min and 5 min and MAS (Table 4). Out of the 225 neonates who developed MAS, Maximum number of neonates i.e., 175 (77.8%) belonged to APGAR score of 4-6 al 1 minute while for APGAR score at 5 minutes, 180 neonates (80%) belonged to 7-10 APGAR Score.This gives credence to the theory that meconium aspiration is predominantly an intrauterine event which occurs in response to continued fetal gasping in a hypoxic environment and tracheal suctioning at birth cannot completely eliminate development of MAS [38,39].

Also, none of the neonates who were vigorous at birth and required only routine newborn care, developed MAS. Therefore, a "selective" approach of tracheal suctioning can be adopted for babies born through MSAF, reserving it for those babies with evidence of fetal distress in-utero and/or, who are in a depressed state at birth. Vigorous neonates only need careful observation after thorough oro-naso-pharyngeal suction [40-42]. Further the results were in contrast to study done by Miller *et al*. We found a significant association of meconium staining of amniotic fluid with Apgar score at 1 & 5 minute, thus signifying the predictive value of meconium-stained amniotic fluid for fetal wellness [14].

Further, fetal hypoxia stimulates fetal evacuation of meconium. Infants born with meconium stained amniotic fluid are at increased risk of fetal hypoxia, evidenced by increased rates of abnormalities indicated by fetal monitoring in labor, low neonatal Apgar scores, and fetal deaths. Appropriate intervention to support ventilation and oxygenation should be initiated as indicated for each infant.

Out of 225 MSAF neonates who developed MAS and admitted in NICU, 187(83.11%) were discharged from NICU with 179 (79.6%) Normal neonates while 7 (3.1%) were neurologically abnormal at time of discharge (Table 5). 26(11.6%) MSAF neonates who developed MAS and admitted in NICU died while 12(5.3%) Neonates leave against medical advice (LAMA). The results of our study were comparable to results of Praveen Goud *et al* [9] Aspiration of thick meconium may occur during the respiratory effort of the first breath, this leads to obstruction of airways, resulting in profound hypoxia. Severe hypoxia may cause brain injury and hypoxic ischemic encephalopathy thus leading to abnormal neurological development. In the present study, mortality was 11% leading cause of death being meconium aspiration syndrome. The results of our study were comparable to Goud *et al*. and Debdas *et al* [9,43].

Conclusion

Meconium stained liquor is known to be associated with increased perinatal morbidity and to some extent perinatal mortality. The detection of meconium stained liquor often causes apprehension and anxiety for the health provider as it is often considered as indicator of fetal distress. Anemia, PIH, Preeclamsia, oligoamnios and fetal growth restriction are associated with an increased risk of meconium stained amniotic fluid.

The identification of the presence of the risk factors should be taken into account to anticipate the possible occurrence of meconium stained amniotic fluid. Meconium stained amniotic fluid is associated with increased rate of operative delivery, low Apgar score and increased neonatal complications. MAS have been found to be one of the most important causes of morbidity & mortality in babies with MSAF. This study is useful in knowing the importance of early interventions. Follow all initial steps of NRP guidelines and endotracheal intubation in depressed MAS babies. The present study shows that by good intrapartum monitoring, timely interventions, oropharyngeal suctioning and endotracheal intubation of selective babies complications of MSAF can be reduced to a great extent.

Limitations

Further studies and research are required in the same aspect to cover the limitations of present study. Limitations being; Firstly, some details of the outborn admissions were not adequate in our study and secondly, we didn't do follow up for the neonates progression of development and to know the various morbidities which these babies can develop later in life; again stressing the importance of early interventions needed in case of MAS babies for better outcome.

Ethical approval: Taken from Ethical committee of institute

References

1. Jirasek JE, Uher J and Koldovsky O. A histochemical analysis of the development of the small intestine of human fetuses. Acta Histochem. 1965:22:33
2. Wong SF, Chow KM, Ho LC. The relative risk of 'foetal distress' in pregnancy associated with meconium-stained liquor at different gestation. J Obstet Gynaecol. 2002; 22:594-9
3. Manivannan V, Murugan JR, Devandiran RS. A study on clinical profile of meconium aspiration syndrome in relation to gestational age and birth weight and their immediate outcome. Int J Contemp Pediatr. 2019;6:1-6.
4. Todres ID, Rogers MC. Neonatal Resuscitation. JAMA. October 28, 1992; 268: 16.
5. Elena M. Rossi, Elliot H, Philipson, Thomas G. Meconium Aspiration Syndrome: Intrapartum & Neonatal Attributes. American journal of obstetrics & gynaecology 1989 November; 161: 1106.
6. Sherry SN, Kramer I. The time of passage of the first stool and first urine by the newborn infant. J Pediatr. 1955 Feb 1; 46(2):158-9.
7. Wiswell TE, Tuggle JM, Turner BS. Meconium aspiration syndrome: have we made a difference? Pediatrics. 1990;85:715-21.
8. Kamala Gokhroo, Usha Sharma *et al*, Various maternal factors responsible for meconium stained amniotic fluid, J. Obstetrics & Gynecology of India. 2001; 51: 6.
9. Goud P and Krishna U. Significance of meconium staining of amniotic fluid in labour. Journal of Obstetrics and Gynaecology of India. 1989; 39:523-526.
10. Rossi EM, Philipson EH, Williams TG, Kalhan SC. Meconium aspiration syndrome: intrapartum and neonatal attributes. American journal of obstetrics and gynecology. 1989; 161(5):1106-10.

11. Harikumar S, Rajesh A. Study on Meconium stained fluid-perinatal outcome. 2018;7(2):587–95.
12. Mundhra R, Agarwal M. Fetal outcome in meconium stained deliveries. Journal of clinical and diagnostic research: JCDR. 2013; 7(12):2874.
13. Gupta V, Bhatia BD, Mishra OP. Meconium stained amniotic fluid: antenatal, intrapartum and neonatal attributes. Indian pediatrics. 1996 1; 33:293-8.
14. Miller, David A, Sacks, MD, Barry S, Schifrin MD, Edward H, Hon MD, Significance of meconium during labour, Am. J. Obstetrics & Gynecology, 1975;122.
15. Rosario MC, Seshadri L. Meconium staining of amniotic fluid in low risk parturients. Journal of Obstetrics and Gynaecology of India. 1996; 46:642-646.
16. Krebs HB, Petres RE, Dunn LJ, *et al*. Intrapartum fetal heart rate monitoring. III. Association of meconium with abnormal fetal heart rate patterns. Am J Obstet Gynecol. 1980;137:936–943.
17. Naveen S, Kumar SV, Ritu S, Kushla P. Predictors of meconium stained amniotic fluid: a possible strategy to reduce neonatal morbidity and mortality. J Obstet Gynecol India. 2006;56(6):514–7.
18. Sedaghatian MR, Othman L, Rashid N, Ramachandran P, Bener AB. An 8-years study of meconium stained amniotic fluid in different Ethnic groups. Kuwait Medical Journal. 2004; 36(4):266-269
19. Oyelese Y, Culin A, Ananth CV, Kaminsky LM, Vintzileos A, Smulian JC. Meconium stained amniotic fluid across gestation and neonatal acid-base status. Obstet Gynaecol. 2006;108(2):345–9.
20. Sandhu S.K, Jaspal Singh, Harpreet khora, Harleen Kaur: Journal of obst and gyn.of India.1993; 43:528.
21. Osava RH, da Silva FM, Vasconcellos de OliveriraSm, Tuesta EF, do Amaral MC. Meconium stained amniotic fluid and maternal and neonatal factors associated. Rev Saude Publica. 2012;46(6):1023-9. Epub 2013 Jan28.
22. Zhu L, Wong F, Bai J. The epidemiology of meconium stained amniotic fluid on hospital basis. Zhongguo Yi XueKeXue Yuan Xue Bao. 2003Feb;25(1):63-5
23. Bharati Rao, Chandashekar GS, Rao D, Hegde P, Ghate S V. Meconium stained amniotic fluid. A prospective study. Karnataka Paediatr Journal. 2011; 25(1):21-6.
24. Vaghela HP, Deliwala K, Shah P. Fetal outcome in deliveries with meconium stained liquor. Int J Reprod Contracept Obstet Gynecol. 2014;3:909-12
25. Neke Akhtar, Fazilatunnesa, SharmeenYasmean. Mode of delivery and fetal outcome in meconium stained amniotic fluid in DMCH, 2006.
26. Rajlaxmi Mundhra and Manika Agarwal, Fetal outcome in Meconium stained deliveries. Journal of clinical and diagnostic research. 2013 Dec.,; 7(12):2874- 287.
27. Unnisa S, Sowmya BS, Rao SB, Rajagopal K. Maternal and fetal out come in meconium stained amniotic fluid in a tertiary centre. Int J Reprod Contracept Obstet Gynecol. 2016;5:813-7.
28. Becker S, Solomayer E, Dogan C, Wallwiener D, Fehm T. Meconiun stained amniotic fluid perinatal outcome and obstetrical management in low – risk sub urban population. Eur J Obstet Gynecol Reprod Biol. 2007;132(1):46- 50.
29. Urvashi Sharma, Swati Garg, Karnika Tiwari, Prabjot Singh Hans, Babit Kumar. Perinatal Outcome in Meconium Stained Amniotic Fluid‖. Journal of Evolution of Medical and Dental Sciences. June 15, 2015; 4(48): 8319-8327.
30. Narang A, Nair PMC, Bhakoo ON, Vashist K.: Management of meconium stained amniotic fluid. A team approach. Indian Pediatrics. 1993;30:9-13.

31. Vora H, Nair S. Study of Meconium Aspiration Syndrome in Neonates.
32. Bhide SS, Shendurnikar S Aiyer, SR Baxi, Neonatal outcome after meconium stained amniotic fluid, J. of Obstetrics & Gynecology of India, 1993; 43; 933.
33. Vinaya Pendse MS, Meconium stained liquor amni: Its significance and effect on fetal outcome, Obstetrics & Gynecology of India,1981.
34. Sheiner E, Hadar A, Shoham-Vardi I, Hallak M, Katz M, Mazor M. The effect of meconium on perinatal outcome: a prospective analysis. J MaternFetal Neonatal Med. 2002;11(1):54–9.
35. Rajlaxmi Mundhra and Manika Agarwal, Fetal outcome in Meconium stained deliveries. Journal of clinical and diagnostic research 2013 Dec.,; 7(12):2874- 287.
36. Osava RH, da Silva FM, Vasconcellos de OliveriraSm, Tuesta EF, do Amaral MC. Meconium stained amniotic fluid and maternal and neonatal factors associated. Rev Saude Publica. 2012;46(6):1023-9. Epub 2013 Jan28.
37. Wong SF, Chow KM, Ho LC. The relative risk of fetal distress' in pregnancy associated with meconium -stained liquor at different gestation. Journal of Obstetrics and Gynaecology. 2002; 22(6):594 -9.
38. Wiswell TE, Henley MA. Intratracheal suctioning, systemic infection, and the meconium aspiration syndrome. Pediatrics. 1992; 89(2):203 -6.
39. Falciglia HS. Failure to prevent meconium aspiration syndrome. Obstetrics & Gynecology. 1988; 71(3):349 -53.
40. Katz VL, Bowes WA. Meconium aspiration syndrome: reflections on a murky subject. American journal of obstetrics and gynecology. 1992; 166(1):171 -83.
41. Wiswell TE, Bent RC. Meconium staining and the meconium aspiration syndrome: unresolved issues. Pediatric Clinics of North America. 1993; 40(5):955 -81.
42. Linder N, Aranda JV, Tsur M, Matoth I, Yatsiv I, Mandelberg H, Rottem M, Feigenbaum D, Ezra Y, Tamir I. Need for endotracheal intubation and suction in meconium -stained neonates. The Journal of pediatrics. 1988; 112(4):613 -5.
43. Debdas AK, Kaur T. Meconium stained liquor – Reappraisal. Journal of Obstetrics and Gynaecology of India. 1981;31:924-929.