

DOI: <http://dx.doi.org/10.18203/2320-1770.ijrcog20184126>

Original Research Article

## The study of meconium staining of amniotic fluid and foetal outcome

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**Received:** 19 July 2018

**Accepted:** 28 August 2018

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### ABSTRACT

**Background:** This study was carried out to determine the effect of meconium stained amniotic fluid on mode of delivery and correlation of thick and thin meconium with foetal outcome.

**Methods:** This prospective observational study was carried out in the Department of obstetrics and gynecology, IGGMC Nagpur from September 2015 to August 2017. All pregnant women in labor with cephalic presentation with singleton pregnancy with meconium stained liquor irrespective of age, parity and stage of labor were enrolled in this study. 200 consecutive study subjects who fulfilled inclusion criteria were included in the study.

**Results:** Out of 200 cases of MSAF, thick meconium was seen in 53.5% cases and thin meconium constituted 46.5% of the cases. The mean gestational age in present study was  $39.31 \pm 0.89$  weeks. Overall incidence of LSCS in meconium stained amniotic fluid is 65.5%. The thick Meconium stained grades had significantly higher NICU admissions when compared to the thin meconium grades ( $p < 0.05$ ). In present study, the total perinatal mortality was 4%.

**Conclusions:** MSAF were associated with higher rate of caesarean delivery. It causes birth asphyxia, MAS, increases NICU admissions and perinatal mortality.

**Keywords:** Meconium staining of amniotic fluid, Foetal outcome

### INTRODUCTION

Meconium constitutes the first stool of a newborn infant. Meconium is a viscous green-black substance that consists of denuded intestinal epithelial cells, ingested lanugo hair, swallowed amniotic fluid, mucus, digestive enzymes, bile acids, and water. Meconium passage in newborn infants is a developmentally programmed event normally occurring within the first 24 to 48 hours after birth. Intrauterine meconium passage in near term or term fetuses has been associated with fetomaternal stress factors and/or infection, whereas meconium passage in post term pregnancies has been attributed to gastrointestinal maturation.<sup>1</sup> Approximately 8% to 15% of all infants are born with evidence of meconium-stained amniotic fluid (MSAF) and this prevalence increases with

gestational age.<sup>1</sup> Meconium passage is rare before 34 weeks of gestations and after 37 weeks its incidence increases steadily with increasing gestational age.<sup>2</sup>

Conflicting outcomes have been reported in the labours, complicated by meconium staining of the amniotic fluid, varying with the degree of meconium staining.<sup>3,4,5</sup> It has been associated with poor perinatal outcome including low Apgar scores, increased rate of chorioamnionitis, increased incidence of neonatal intensive care admission and high rate of perinatal death.<sup>6</sup>

The risk factors for meconium stained amniotic fluid are both maternal and fetal. The maternal factors are hypertension, gestational diabetes mellitus, maternal chronic respiratory or cardiovascular diseases, post term

pregnancy, preeclampsia, eclampsia. The fetal factors include oligohydramnios, intrauterine growth restriction, poor biophysical profile.<sup>7</sup> MSAF is associated with higher rate of caesarean delivery, increased need for neonatal resuscitation and meconium aspiration syndrome.<sup>8</sup> Aspiration of meconium by the fetus remains relatively common cause of perinatal morbidity and mortality because it is difficult to prevent.<sup>9</sup>

This study was carried out to determine the effect of meconium stained amniotic fluid on mode of delivery and the correlation of thick and thin meconium with foetal outcome.

## METHODS

This is an observational study, carried out in the Department of Obstetrics and Gynaecology at Indira Gandhi Government Medical College and Hospital Nagpur, Maharashtra, India over a period of September 2015 to August 2017 after obtaining institutional ethics committee approval. Informed consent taken from all the subjects. The subjects with meconium stained amniotic fluid (MSAF), detected after spontaneous or artificial rupture of membranes, taken as cases. The cases further divided into 2 subgroups; A-thin, B-thick. All term pregnant women in labor with cephalic presentation with singleton pregnancy with meconium stained liquor irrespective of age, parity and stage of labor were enrolled in the study. Patients having malpresentation, multiple pregnancies, fetal malformation, intrauterine fetal demise, eclampsia, antepartum hemorrhage were excluded from this study. 200 consecutive study subjects who fulfill inclusion criteria were included in the study.

Patients detailed history, gestational age, per abdominal examination, per speculum and per vaginal examination were recorded in a pre-designed proforma. Fetal heart rate monitoring was done with intermittent auscultation. The rate of cervical dilatation, duration and progress of labour was noted by plotting the parameters on a partogram. If there are any associated complications like PIH, PROM, anemia, the specific treatment was given. The mode of delivery will be dependent upon the fetomaternal condition and progress of labor. The APGAR score of neonates at 1 and 5 minutes, NICU admission, the neonates who had meconium aspiration syndrome and birth asphyxia in thick and thin group were recorded.

### Statistical analysis

The data was collected and compiled using Epi info 7.2. The quantitative variables were expressed in terms of proportions and the difference between two proportions was tested by chi square or fisher exact test. The quantitative variables were either categorized and expressed in percentage or expressed in terms of mean and standard deviation. All analysis was two tailed and significance level was set at 0.05.

## RESULTS

Out of 200 cases of MSAF, thick Meconium was seen in 53.5% cases and thin Meconium constituted 46.5% of the cases. The mean age of the mothers in present study was 25.00±3.30 years. Maximum cases of Meconium stained amniotic fluid were seen in the age group of 21-30 years i.e. 87%. There was no association between the grade of meconium and gravida status ( $p > 0.05$ ), but overall incidence of meconium stained amniotic fluid was more in primigravida. Meconium stained amniotic fluid was more commonly seen between 39-40 weeks of gestation. The mean gestational age in present study was 39.31±0.89 weeks.

In present study, majority of the study subjects had PIH (14.5%) as an associated risk factor followed by PROM (10%), anaemia (4%) and oligohydramnios (2%). More than one risk factor was present in some cases (7.5%).

**Table 1: Distribution of study subjects according to grade of meconium, maternal age, parity, gestational age and associated risk factors.**

Variables	Frequency	Percentage	
Thin	93	46.5	
Thick	107	53.5	
Maternal age	< 20 year	21	10.5
	21-30 year	174	87
	>30 year	5	2.5
Parity	Primi	121	60.5
	Multi	79	39.5
Gestational age	37-37 <sup>+6</sup>	26	13
	38-38 <sup>+6</sup>	46	23
	39-39 <sup>+6</sup>	78	39
	40-40 <sup>+6</sup>	50	25
Associated risk factors	PIH	29	14.5
	PROM	20	10
	Anaemia	8	4
	Oligo	4	2
	IUGR	3	1.5
	More than one	15	7.5

Out of the cases with thin meconium stained amniotic fluid, 46.24% had normal vaginal delivery, while in thick meconium stained amniotic fluid only 15.9% delivered normally. Incidence of LSCS was more in thick meconium stained amniotic fluid i.e., 78.5% as compared to 50.53% with thin meconium stained amniotic fluid. Overall incidence of LSCS in meconium stained amniotic fluid is 65.5%. Low Apgar scores were seen in cases with thick meconium as compared to those with thin meconium ( $p < 0.05$ ). The thick Meconium stained grades had significantly higher NICU admissions when compared to the thin Meconium grades ( $p < 0.05$ ). In present study, the total perinatal mortality was 4%. 7 deaths occurred in thick meconium including 1 stillbirth as compared to 1 in thin group which was statistically significant ( $p < 0.05$ ).

**Table 2: Mode of delivery, APGAR score, NICU admission, perinatal death.**

Variables	Thin (n=93)		Thick (n=107)		P value	
	No.	%	No.	%		
Mode of delivery	Vaginal	43	46.24	17	15.90	<0.001
	Instrumental	3	3.23	6	5.60	0.4177
	LSCS	47	50.53	84	78.50	<0.001
Apgar score at 1 minute	0 to 3	1	1.1	16	15.00	<0.001
	4 to 6	16	17.2	32	29.9	0.0351
	7 to 10	76	81.7	59	55.10	<0.001
Apgar score at 5 minutes	0 to 3	0	0	7	6.5	<0.001
	4 to 6	3	3.2	14	13.1	0.0123
	7 to 10	90	96.8	86	80.4	<0.001
NICU admission	4	4.34	22	20.56	0.002	
Perinatal death	1	1.07	7	6.54	0.049	

**Table 3: Distribution of study subjects according to the cause of neonatal morbidity and mortality.**

Causes	Thin MSAF (n=93)			Thick MSAF (n=107)				
	Morbidity	%	Mortality	%	Morbidity	%	Mortality	%
Asphyxia	3	3.22	1	1.07	8	7.47	1	0.93
MAS	0	0	0	0	10	9.4	3	2.8
Sepsis	1	1.07	0	0	3	2.8	2	1.87
Pneumonitis	0	0	0	0	1	0.93	0	0
Total	4	4.3	1	1.07	22	20.6	6	5.6

MAS followed by birth asphyxia and sepsis were mostly responsible for neonatal morbidity and mortality. All cases of MAS were seen in thick meconium group.

## DISCUSSION

Detection of MSAF during labour causes apprehension and anxiety to health provider as it is often considered as indicator of foetal distress.<sup>7,9</sup> It is assumed that an abnormal fetal heart rate during labour especially, in presence of meconium stained liquor is a sign of hypoxia and acidosis, especially in the set up where facilities of CTG and fetal scalp blood pH estimation are not available.<sup>10</sup>

The passage of meconium may be a normal physiologic event reflecting fetal maturity. It may on other hand reflect fetal hypoxia or increased vagal activity from cord compression. Although meconium is sterile its passage into amniotic fluid is important because of risk of developing MAS and its sequelae.<sup>10</sup>

A significant association has been reported between the consistency of meconium (thick versus thin) and abnormal fetal heart rate patterns, increased rates of caesarean section, low Apgar scores and acidic umbilical cord pH.<sup>8</sup> It is a frequent cause for poor foetal outcome as it increases the perinatal morbidity and mortality.

In the studies conducted by Debdas (78.75%) and Sheikh EM (78%) the incidence of thin meconium was 78.75%

and 78% respectively.<sup>8,11</sup> However, in the present study the incidence of thick MSAF was slightly higher at 53.5% as compared to thin MSAF at 46.5%. The findings of present study are comparable to the study conducted by Arun who quoted almost similar incidence of thick MSAF and thin MSAF i.e. 51.15% and 48.85%.<sup>12</sup> The difference in incidence of thick and thin MSAF noted by different studies may be possibly because thin MSAF being more prone for variation.<sup>13</sup>

Eighty-seven % of patient belonged to age group 21-30 years correlating to with study conducted by Ghokhroo K (86.6%) and Sandhu SK (80%).<sup>14,15</sup> Highest incidence of MSAF was noted in primigravida's i.e. 60.5%. The present study was correlating with the study done by Surekha (71.66%) and Gokhroo K (54%) et al.<sup>14,16</sup> This may be due to increased duration of labour and increased incidence of postpartum in primigravida's.

This study also correlated with study conducted by Unnisa S and Becker et al with incidence of MSAF slightly higher in primigravida's.<sup>17,18</sup> However, in the study done by Mundhra R a slightly higher incidence of MSAF was seen in multigravida's (51.52%).<sup>19</sup>

Sunoo et al found significant increased rate of MSAF at 39 weeks of gestation. Similar findings to that were seen in studies conducted by Sandhu SK et al and Unnisa S.<sup>15, 17, 20</sup> Likewise in the present study authors also found that rate of meconium staining in amniotic fluid increased with gestational age, maximum being after 39 weeks of

gestation (mean 39.31). This can be explained by that the hormone motilin is secreted in increasing quantities by fetus as gestation advances. Most meconium discharges are said to occur in post-dated gestation, because the motilin levels are highest then.<sup>21</sup>

Elevated cord blood erythropoietin levels have been noted in fetuses with advanced gestation and in fetuses with meconium passage at any gestational age, possibly indicating that an element of hypoxia contributes to the passage of meconium in utero.<sup>22</sup> Association of PIH with MSAF is caused by an underlying uteroplacental insufficiency, which causes foetal hypoxia, resulting in meconium passage.<sup>19</sup>

In the present study oligohydramnios and IUGR were other risk factors (incidence was 5% and 4% respectively). Meconium staining is more common in growth retarded babies. They, being subjected to chronic intrauterine hypoxia.<sup>13</sup> Higher rate of pregnancy induced hypertension among meconium stained liquor patients was found in the study of Mundra et al.<sup>19</sup> Naveen et al identified fetal growth retardation as an independent risk factor for meconium stained amniotic fluid (p=0.01).<sup>13</sup>

There was increased incidence of operative delivery in present study with overall rate of caesarean section being 65.5%. Incidence of LSCS was more in thick group (78.5%) as compared to thin group (50.53%). Espinheira MC et al in his study reported the caesarean section rate of 62.5%.<sup>23</sup> Mundhra R et al inferred that caesarean section was a most common mode of delivery in their study.<sup>19</sup> Among the cases 49.09% underwent caesarean section.

Naqvi reported that caesarean section was three times more common in MSAF group.<sup>10</sup> Wong found that 13.2% of MSAF versus 8.8% of clear amniotic fluid had undergone caesarean section.<sup>24</sup> Naveen and Patil reported a caesarean section rate of 49.1% and 42%.<sup>13,25</sup> Unnisa S reported caesarean section rate of 45%.<sup>17</sup> Becker reported that all sorts of operative interventions are more frequent in MSAF group.<sup>18</sup> In their study 17.4% of patients in meconium group had caesarean section as compared to 9.6% of control group (P value 0.01).

In present study, rate of caesarean section in patients with MSAF are higher than those reported by other authors. This may be due to lack of facilities such as fetal scalp pH monitoring and infrequent availability of tracings of electronic fetal monitoring and skewed patient doctor ratio. The lower rates of caesarean and instrumental deliveries in other studies could be due to better facilities to assess fetal wellbeing. The significant high rate of emergency caesarean section partly reflects the care providers dilemma in managing such labors as they become more concerned about the fetuses and any minute alterations in normal labor patterns end up in caesarean sections.<sup>19</sup> Sasikala et al reported that MSAF alone is not an indication of caesarean section, however patients with

MSAF need strict supervision during labor for better perinatal outcome.<sup>26</sup>

In present study the 1 minute and 5-minute Apgar score were studied as measures of neonatal outcome and statistically significant number of infants with thick meconium had low Apgar scores as compared to thin group. Thick meconium as single variable appeared to be most significant factor influencing fetal outcome.

Starks have reported significantly lower 1 and 5-minute Apgar scores in babies with thick meconium but no increased risk in babies with thin meconium.<sup>27</sup> Naqvi reported that unsatisfactory Apgar scores were two times more common in MSAF.<sup>10</sup> Wong identified 29% of MSAF versus 19.4% of clear amniotic fluid group having low 1 minute Apgar scores.<sup>24</sup> However, Becker found no statistically relevant difference in the Apgar scores of the sub groups of meconium.<sup>18</sup> The low Apgar score may be because of direct vasoconstrictor effect of meconium on umbilical vein that results in vasospasm leading to impaired placental blood flow.<sup>16</sup>

**Table 4: Different studies showing correlation between type of meconium and NICU admissions.**

Studies	NICU admissions	
	Thin	Thick
Goud P <sup>28</sup>	10.8%	54.9%
Jeena S <sup>29</sup>	9.2%	14.1%
Narli N <sup>30</sup>	8.4%	11.2%
Priyadarshni M <sup>31</sup>	5.6%	8.4%
Present Study	4.34%	20.56%

NICU admission requirement and period of stay was higher in thick meconium stained group than thin meconium stained group. In present study incidence of birth Asphyxia was 3.22% in thin group and 7.47% in thick group. Sheikh EM et al also found the incidence of birth asphyxia was significantly higher in thick meconium as compared to thin meconium.<sup>8</sup> Many workers noted that all cases of meconium aspiration syndrome were seen only in thick meconium group.<sup>32</sup> Similarly, in present study, all cases of MAS were seen in thick meconium group. Gupta et al found that birth Asphyxia was significantly high in meconium stained amniotic fluid.<sup>33</sup> Khatun found 12.9% birth asphyxia cases in her study with significant increase in requirement of oropharyngeal suctioning.<sup>34</sup>

In present study incidence of meconium aspiration syndrome was 9.4% in the thick group. Patil et al and Naqvi had reported an incidence of 12.8% and 4.1% respectively whereas Bhide et al reported a much higher rate of meconium aspiration syndrome (22%).<sup>10,25,32</sup> Thus, it is clear that the consistency of the meconium i.e. thick versus thin has a significant effect on the perinatal outcome.

**Table 5: Different studies showing incidence of perinatal mortality.**

Studies	Perinatal Mortality
Patil <sup>25</sup>	9.52%
Goud and Krishna <sup>28</sup>	7.7%
Narang <sup>35</sup>	7.7 %
Usha <sup>36</sup>	6%
Debdas <sup>12</sup>	3%
Khatun <sup>34</sup>	2.9 %
Unnisa S <sup>17</sup>	2%
Present study	4%

Meconium aspiration syndrome and birth asphyxia is responsible for most cases of perinatal morbidity and mortality in the present study.

Literature suggests that meconium itself has potentially detrimental effects on fetal tissues and organs. It stimulates umbilical vessel constriction and causes vessel necrosis and may produce thrombi leading to tissue ischemia. Meconium though is sterile but reduces the antibacterial property of amniotic fluid by altering levels of zinc and thus facilitates intra-amniotic infections. In presence of fetal stress such as hypoxia the gasping actions of the foetus may lead to aspiration of meconium into the lungs promoting lung tissue inflammation and respiratory distress.<sup>16</sup>

## CONCLUSION

MSAF were associated with higher rate of caesarean delivery. It causes birth asphyxia, MAS, increases NICU admissions and perinatal mortality.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: The study was approved by the Institutional Ethics Committee*

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**Cite this article as:** Gavhane B, Thakare S, Wankhede S. The study of meconium staining of amniotic fluid and foetal outcome. *Int J Reprod Contracept Obstet Gynecol* 2018;7:4042-7.