THE SIGNIFICANCE OF MECONIUM STAINED AMNIOTIC FLUID – A CROSS SECTIONAL STUDY IN A RURAL SETUP

Surekha Tayade*

*Dept of Obstetrics and Gynaecology, Mahatma Gandhi Institute of Medical Sciences, Sewagram, Wardha, Maharashtra, India
E-mail of Corresponding Author: surekhatayademgims@yahoo.co.in

Abstract

Background: The significance of meconium in amniotic fluid is a widely debated subject. Traditionally meconium has been viewed as a harbinger of impending or ongoing fetal compromise; however some investigators believe that it is not associated with fetal hypoxia, acidosis or fetal distress. Others have found lower Apgar scores in meconium stained neonates.

Objectives: To study the correlation of meconium in amniotic fluid with perinatal outcome.

Methods: 120 consecutive, term, labouring women with meconium stained amniotic fluid on spontaneous/artificial rupture of membranes were monitored during labour with fetal heart rate abnormalities, one and five minute apgar score , umbilical cord pH at birth and neonatal complications, as outcome variables.

Results: Fetal heart rate variations were more often in cases with thick meconium (86.36%) than with thin meconium (9.75%) (p value < 0.005). Thick meconium group neonates had lower Apgar scores as compared to moderate and thin meconium group. The umbilical cord blood pH was below 7.2 in 4(11.4%) neonates of thin meconium, 15(42.85%) in moderate meconium and 30(68.18%) in thick meconium group (P value below 0.001). Neonatal complications were found in 36.36% of thick meconium group as compared to 14.28% of moderate meconium and none in thin meconium.

Conclusions: Thick meconium should suggest immediate intervention, need for skilled paediatrician at the time of delivery and intensive care in the neonatal period to give a positive outcome

Keywords: Meconium stained amniotic fluid, Intrapartum meconium

1. Introduction

Meconium is the name given to substances which have accumulated in the fetal bowel during intrauterine life. Although 69 % of newborns pass meconium by 12 hours of age, many infants pass meconium prior to birth as well1. Various studies have reported an incidence of meconium stained amniotic fluid ranging from 1.5 to 18 %2. It has been suggested that the fetus passes meconium in response to hypoxia and that meconium therefore signals fetal compromise. Alternatively, in utero passage of meconium may represent normal gastrointestinal tract maturation under neuronal control. Meconium passage could also follow vagal stimulation from common but transient umbilical cord entrapment3.

The significance of meconium in amniotic fluid is a widely debated subject. Traditionally meconium has been viewed as a harbinger of impending or ongoing fetal compromise; however some investigators believe that it is not associated with fetal hypoxia, acidosis or fetal distress4. Others have found lower Apgar scores in meconium stained neonates5. The predictive value of meconium was better when it occurred in high risk patients and was thick, dark and tenacious. Lightly stained meconium had a poor correlation with fetal hypoxia6. The moderate and thick meconium group has a significantly greater risk of an abnormal FHR tracing, a 1 and 5 minute Apgar score less than 7, a cord blood pH of less than 7.2, sepsis, need for O2 support and level III NICU admission of babies7. However, many babies born with MSAF have normal umbilical artery pH, so recent literature tends to disregard the importance of intrapartum meconium as a sign of fetal hypoxia. Aspiration of the meconium into fetal or neonatal lungs is associated with clinical disease ranging from mild respiratory distress to severe respiratory compromise and causes significant increase in perinatal morbidity and mortality8. Thus this study was done with an objective to correlate the presence of meconium in amniotic fluid with perinatal outcome so as to know its significance as an indicator of fetal distress.

2. Material and Methods

The present study was carried out in the department of Obstetrics and Gynaecology of a tertiary care institute of a rural area, prospectively over a period of 8 months. 120 consecutive
women who reported to the labour unit with single, intraventricular term live foetus with cephalic presentation, spontaneous onset of labour with 3 cm or more cervical dilatation and in whom there was presence of meconium in amniotic fluid on spontaneous rupture of membranes (SRM) or artificial rupture of membranes (ARM) were included in the study after proper consent.

Meconium was graded as “thick “ if the fluid was viscous, tenacious and contained large amount of particulate material, “thin” if fluid was normal except for greenish colouring and was considered moderate if it was thicker and darker in colour. The labour was monitored closely and the mode of delivery, Apgar scores at one and five minutes and umbilical cord blood pH at birth were recorded. The neonate was followed in the immediate postpartum period and the outcome was noted. The data was analysed with Epi Info software. Ethical clearance was obtained from institutional ethical committee.

3. Results

During the study period of 8 months there were 3673 births and 120 women had meconium stained amniotic fluid (3.48%). The mean age of the study population was 23.02 years. Maximum number of women were primigravida (71.66 %), 21.67% were second gravida, 5 % were third gravida and 1.67 % were fourth gravida. Thin meconium was present in 41 (34.16%), moderate in 35 (29.16 %) and thick in 44 (36.66 %) (Table 1). Fetal heart rate variations were more often in cases with thick meconium 38(86.36%) than with thin meconium 4(9.75 %) (p value < 0.005). Two (4.54%) of the thick meconium group had normal delivery and 42 (95.45%) had operative delivery; 8 (22.85%) in moderate meconium had normal delivery and 27 (77.14%) had LSCS whereas 35(85.36%) in thin meconium group had normal delivery and only 6 (14.63%) had LSCS. Difference is statistically significant ( p value below 0.01). The one minute Apgar score was between 4-6 in 17.07% of thin meconium group, 28.57 % of moderate meconium and 47.72 % in thick meconium group. The difference was statistically significant with a p value < 0.005. One neonate (3.84%) in thin meconium group, 7 (20%) in moderate meconium group and 13 (29.54 %) in thick meconium group had 1 minute Apgar score between 0-3. The umbilical cord blood pH was below 7.2 in 4(11.4%) neonates of thin meconium, 15(42.85%) in moderate meconium group and 30(68.18%) in thick meconium group (P value below 0.001(Table 2). None of the babies of thin meconium group had adverse neonatal outcome. In moderate meconium group 5(14.28%) babies had neonatal complications; out of these 2 had septicemia, 1 had hypotonia, 1 had meconium aspiration syndrome and 1 baby had neonatal seizures. Thick meconium group had 16(36.36%) babies with neonatal complications out of which 6 had meconium aspiration syndrome 2 had septicemia 6 neonatal seizures and 2 had hypotonia. The difference was statistically significant with a P value below 0.001.There were 5 neonatal deaths in the study population ;1 in moderate meconium group and 4 in thick meconium group. The cause of death in 4 neonates was birth asphyxia with meconium aspiration syndrome and in 1 neonate cause of death was severe birth asphyxia with septicaemia.

4. Discussion
The detection of meconium stained amniotic fluid during labour often causes apprehension and anxiety for the health provider as it is often considered an indicator of fetal distress 7. However the obstetric literature still has many unanswered questions regarding the significance of meconium in the amniotic fluid and the appropriate management protocols that should be followed when it is discovered. It is believed by some medical experts that the passage of meconium is triggered by fetal stress, such as hypoxia or asphyxia, and that the presence of meconium in the fluid may be considered an indicator of fetal distress. Others point out that the presence of meconium in the amniotic fluid also may be a result of gastrointestinal maturity. Normal preterm foetuses rarely pass meconium; meconium passage in term or post term pregnancies is observed more frequently. Many researchers disregard the importance of meconium stained amniotic fluid as an indicator of fetal hypoxia. However 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 pH8-11.
In the early 2000, the prevalence of meconium aspiration syndrome (MAS) ranged from 0.20% to 0.54% in the general population and from 1.0% to 6.8% in infants born through meconium stained amniotic fluid (MSAF). Stark and Harrington reported a combined incidence of 13.1% for MSAF, 0.52% of MAS, 4.2% of MAS among MSAF, and 49.7% of MAS requiring ventilatory support with a 4.6% mortality rate. The national US birth cohort study conducted on the basis of singleton term non-Hispanic white live births (1995–2001) showed that the rate of MAS markedly increased with gestational age i.e. from 0.10% at 37 weeks gestation to 0.22 and 0.31% at 40 and 41 weeks gestation, respectively. The present study found an incidence of 3.48%. It may be associated with fetal compromise and may also occur in uncomplicated labours. Possible causes which have been proposed are fetal hypoxia, vagally mediated peristalsis in response to cord compression and a direct effect on the fetal gastrointestinal tract of maternal medication such as misoprostol castor oil and certain herbal remedies. Thick but not thin meconium is associated with poor perinatal outcome. Stark et al reported that acute or chronic fetal hypoxia can result in the passage of meconium in utero.

Presence of meconium below the vocal cord is known as meconium aspiration syndrome and occurs in 20 to 30% of all infants with MSAF with around 12% mortality. Aspiration can occur with fetal gasping or after birth with first breaths of life. Although meconium is sterile, its passage into the amniotic fluid carries the risk of meconium aspiration syndrome and its sequelae and can lead to increased perinatal morbidity and mortality despite the fact that the vast majority of infants born with MSAF show no long term impairments. Most studies show a link between meconium, low Apgar scores and decreased arterial cord pH values; however some show no correlation. Studies also suggest that there may be racial and socioeconomic differences in the risk of developing MAS. In the present study MSAF was more common in primigravida and most of the women were from rural area and belonged to the low socioeconomic group. A study conducted by Becker et al too reveals that meconium is more common in nulliparous women.

Sheiner et al have reported that thick and not thin meconium-stained amniotic fluid is associated with an increased risk for perinatal complications during labor and delivery. In the present study fetal heart rate variations were more commonly seen in thick meconium group as compared to thin meconium group (86.36% versus 9.75%). Many other researchers have reported an increased incidence of abnormal fetal heart rate patterns in presence of MSAF. Naqvi found that 45% of meconium group had FHR variation as compared to 11% of no meconium group. Patil found that 56% of MSAF had fetal heart abnormalities. Wong found abnormal cardiotocographs in 9.7% of MSAF versus 5.7% of clear fluid group. Naveen identified clinical fetal distress in 27% of MSAF versus 8.5% of unexposed group.

In the present study statistically significant more number of women in thick and moderate meconium group underwent caesarean section as compared to thin meconium group. Becker reported that all sorts of operative interventions are more frequent in MSAF group compared to clear fluid group. 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). Naqvi reported that C section was three times more common in MSAF group. Wong found that 13.2% of MSAF versus 8.8% of clear amniotic fluid had c section. Patil reported a C section rate of 42% and Naveen 49.1%. Sasikala et al have reported that MSAF alone is not an indication of caesarean section, however patients with MSAF need strict supervision during labour for better perinatal outcome.

Starks had reported significantly lower 1 and 5 minute Apgar scores, lower scalp pH values in babies of thick meconium but no increased risks in babies of thin meconium. Thick meconium as single variable appeared to be most significant factor influencing fetal outcome. In the present study the 1 minute and 5 minute Apgar scores were studied as a measure of neonatal outcome and statistically significant number of infants in moderate and thick meconium group had low Apgar scores as compared to thin group. Many researchers have reported similar findings. Naqvi reported that unsatisfactory Apgar scores were two times more common in MSAF. Wong identified 29% of MSAF versus 19.4% of clear fluid group had low 1 minute Apgar scores. However Becker found no statistically relevant difference in the Apgar scores of the subgroups of meconium. The low Apgar scores may be because of direct vasoconstrictor effect of meconium on umbilical vein that results in vasospasm leading to impaired placental blood flow.
The umbilical cord blood pH was below 7.2 in 4(11.4%) neonates of thin meconium, 15(42.85%) in moderate meconium group and 29(65.91%) in thick meconium group (P value below 0.001) in our study. None of the babies of thin meconium group had adverse neonatal outcome. In moderate meconium group 14.28% and in thick meconium group 36.36 % had neonatal complications in the form of MAS, sepsicaemia, hypotonia and respiratory distress. There were 5 neonatal deaths in the study population. Naqvi reported an incidence of 4 % MAS and 2.5 % perinatal deaths in meconium group. Patil reported 12.8 % MAS and 4 % perinatal deaths. Thus it is clear that the consistency of the meconium i.e. thick versus thin has a significant effect on the perinatal outcome. 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 reduces the antibacterial property of amniotic fluid by altering levels of zinc and thus facilitate intraamniotic infections. In the presence of fetal stress such as hypoxia the gasping actions of the fetus may lead to aspiration of meconium into the lungs promoting lung tissue inflammation and respiratory distress.

5. Conclusion
We conclude that moderate and thick meconium is associated with increased operative interventions, low Apgar scores, reduced umbilical cord pH, increased risk of birth asphyxia, meconium aspiration syndrome and overall increased perinatal mortality. However, thin meconium is shown to have low risk of perinatal complications. Thus identification of women at risk for passage of meconium in utero, antenataly is important so that intrapartum surveillance of these can be improved. Once intrapartum meconium is identified in the amniotic fluid close monitoring of the fetus with CTG or clinically, becomes imperative. Thick meconium should suggest immediate intervention, need for skilled paediatrician at the time of delivery and intensive care in the neonatal period to give a positive outcome

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| Determinant        | Thin Meconium (41(34.16%) | Moderate Meconium (35(29.16%) | Thick Meconium (44(36.66%) | Total (120(100%)) |
|--------------------|--------------------------|-------------------------------|--------------------------|-------------------|
| Age                |                          |                               |                          |                   |
| < 20 years         | 3(2.5%)                  | 3(2.5%)                       | 4(3.33%)                 | 10(8.33%)         |
| 21-25 years        | 34(28.33%)               | 25(20.83%)                    | 29(24.16%)               | 88(73.33%)        |
| 26-30 years        | 4(3.33%)                 | 7(5.83%)                      | 10(8.33%)                | 21(17.5%)         |
| >30 years          | 0                        | 0                             | 1(0.83%)                 | 1(0.84%)          |
| Gravidity          |                          |                               |                          |                   |
| Primigravida       | 32(26.66%)               | 24(20%)                       | 30(25%)                  | 86(71.66%)        |
| 2nd Gravida        | 8(6.66%)                 | 8(6.66%)                      | 10(8.33%)                | 26(21.67%)        |
| 3rd Gravida        | 1(0.83%)                 | 2(1.66%)                      | 3(2.5%)                  | 6(5%)             |
| 4th gravida        | 0                        | 1(0.83%)                      | 1(0.83%)                 | 2(1.67%)          |
| Mode of delivery   |                          |                               |                          |                   |
| Normal Delivery    | 35(85.36%)               | 8(22.85%)                     | 2(4.54%)                 | 45(37.5%)         |
| LSCS               | 6(14.63%)                | 27(77.14%)                    | 42(95.45%)               | 7562.5%           |
Table 2 - Correlation of grades of Meconium Stained Amniotic fluid with fetal determinants

| Determinants          | Mild Meconium | Moderate Meconium | Thick Meconium | P value |
|-----------------------|---------------|-------------------|----------------|---------|
| FHR Variations        |               |                   |                |         |
| Apgar Score 1 minute 4-6 | 4(9.75%)     | 5(14.28%)         | 38(86.36%)     | X²=11.02 df=2 p<0.005 |
| Apgar Score 1 minute 0-3 | 1(3.84%)     | 7(20%)            | 13(29.54%)     | X²=11.04 df=2 p<0.005 |
| Apgar Score 5 minute 4-6 | 1(3.84%)     | 5(14.38%)         | 12(27.27%)     | X²=8.72 df=2 p<0.02   |
| Apgar Score 5 minute 0-3 | 0            | 0                 | 1(2.27%)       |         |
| Umbilical Cord pH <7.2 | 4(15.38%)    | 15(42.85%)        | 30(68.18%)     | X²=25.61 df=2 p<0.001 |
| Adverse neonatal outcome | 1(3.84%)   | 5 (14.28%)        | 16(36.36%)     | X²=17.6 df=2 p<0.001  |