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An Observational Study on Acid-Base Status and Clinical Outcome in Babies with Meconium Aspiration

Ghazi Sharique Ahmad	Associate Professor, Department of Pediatrics, Katihar Medical College, Katihar, Bihar, India, * Corresponding author
Kumar Shambhu Nath	Associate Professor, Department of Pediatrics, Katihar Medical College, Katihar, Bihar, India.
Narendra Kumar	Post Graduate Trainee, Department of Pediatrics, Katihar Medical College, Katihar, Bihar, India
Abu Irfan	Post Graduate Trainee, Department of Pediatrics, Katihar Medical College, Katihar, Bihar, India

ABSTRACT

Objective: Study was to evaluated the acid base status and compare clinical outcome and prognosis of severity of Meconium Aspiration Syndrome of neonates having MAS of umbilical arterial cord blood PH> 7.2 & <7.2. Methods: Neonates were examined and all necessary investigations were performed. A segment of umbilical cord was double clamped and arterial blood gas collected with a heparinized syringe and transported immediately for analysis. Respiratory distress was monitored by Silverman's scoring. Results: Data was analyzed by using MS-Office soft ware. Conclusions: Severity & mortality of MAS was more with Umbilical Arterial PH status < 7.2.

KEYWORDS : Meconium Aspiration Syndrome, Umblical Arterial pH

Introduction:

Meconium first appears in the fetal ileum between 10 and 16 week of gestation as a viscous, green liquid composed of gastrointestinal secretion. Cellular debris, bile and pancreatic juice, Mucus blood, Lanugo and Vernix.[1]

Meconium Aspiration Syndrome (MAS) is a disease unique to the newborn infant in which meconium stool is passed at some time before birth and aspirated into the lungs before or during parturition. MAS remain one of the most common causes of neonatal respiratory distress.[2,3,4]

Under normal circumstance, the passage of meconium from the fetus into the amnion is prevented by the lack of intestinal peristalsis, which is caused by several factors, including low motilin levels, Tonic contraction of the anal sphincters, and or terminal cap of viscous meconium. MSAF may be a natural phenomenon that neither indicates nor causes fetal distress but simply reflects a postterm fetus with a mature gastrointestinal tract in which motilin levels have rise. Vagal stimulation produced by cord or head compression also may be associated with the passage of meconium in the absence of fetal distress. In contrast, meconium passage may occur secondary to and in utero stress, with resultant fetal hypoxia and acidosis producing relaxation of the anal sphincter[1].

Meconium is approximately 72% to 80% water. The dry weight composition consists primarily of Mucopolysaccharides, with less protein and lipid, Although intestinal meconium appears very early in gestation, MSAF (Meconium Stained Amniotic Fluid) rarely occurs at less than 38 weeks of gestation. Incidence of MSAF increases thereafter and approximately 30% of newborn have MSAF after 42 weeks of gestation. The increased incidence of MSAF with advancing gestational age probably reflects the maturation of peristalsis in the fetal intestine[1].

Other Risk factors for meconium - stained amniotic fluid are -maternal hypertension, maternal diabetes mellitus, post term pregnancy, pre-eclampsia/eclampsia, oligohydramnios, intrauterine growth retardation and abnormal fetal heart rate pattern.[6]

The severity of the disease is variable from only mid respiratory distress to respiratory failure in association with pulmonary hypertension and persistent fetal circulation.

Approximately 13% of all live births are complicated by meconium stained amniotic fluid (MSAF) fortunately, only 5% of neonates born through MSAF develop MAS.[7,8]

Three types of meconium have been described according to consistency.[9]

Mild-watery, Moderate -opaque without particles, *Thick* -pea soup with particle.

Yellow meconium is usually old, whereas green meconium suggests a more recent insult.

Review of obstetric literature reveals a strong relationship between intrapartum fetal hypoxia- ischemia and the development of meconium aspiration. *Roosi et al*[11] noted that fetal heart rate abnormalities, caesarean delivery for fetal indications, and fetal acidemia occurred more often with meconium aspiration syndrome in neonates delivered through meconium-stained amniotic fluid.

In animal models, hypoxia, severe enough to cause acidosis results in aspiration of meconium. Instillation of meconium before the first breath in asphyxiated animals causes a syndrome of respiratory distress requiring ventilation that mimics MAS.

Meconium below cord, an experimental study on pregnant guinea pigs with asphyxia (PH<7.1 for 120 minutes) immediately before delivery, and instillation of clear amniotic fluid or thick meconium at the time of the first breath in the pups, demonstrate extensive necrosis, diffuse haemorrhage, and alveolar wall destruction in both groups of animals, suggesting that asphyxia rather than meconium damaged the lung.

Thus acidosis severe enough to result severe distress in the babies with MSL may be the pointer of severe hypoxemia and not the isolated presence of meconium below cord.

The rationale of our study was to see exactly is it really meconium

and its different consistencies that cause respiratory distress or the antenatal maternal risk factors with hypoxia and acidosis that causes asphyxia related lung injuries and respiratory distress. It was to evaluated the acid base status of babies having meconium aspiration and compare clinical outcome and severity of Meconium Aspiration Syndrome (MAS) in cases having umbilical arterial cord blood PH≥ 7.2 & <7.2 and to prognosticate the severity of MAS in relation to PH status (pH≥ 7.2 & <7.2).

Materials & Methods:
A total of 110 neonates admitted in neonatal intensive care unit, intermediate care nursery and postnatal ward of Katihar Medical College, Katihar, Bihar, India, were included in this study. The attendant of entire subject signed an informed consent approved by institutional ethical committee of Katihar Medical College, Katihar, Bihar, India was sought. Data was collected on the basis of inclusion and exclusion criteria, with irrespective of sex during period of September 2015 to February 2016.

Study design was Prospective study. Inclusion criteria: Term babies ≥ 37 weeks POG born through MSAF and those who were required Meconium suctioning below vocal cord. Exclusion Criteria: Gestational age < 37 weeks, Multiple gestational and Presence of fetal structural anomalies.

Methods:
Meconium was suctioned using mucus aspirator and amount measured as per calibration indicated in it. All infants were taken standard treatments as per nursery/NICU protocols. Temperature maintenance, blood sugar and serum Ca^{+2} measured and 1st chest X-ray were performed after 6 hours of life. Oropharyngeal suctioning or orotrachael suctioning were performed by pediatrician.

Protocols: A segment of umbilical cord was double clamped and arterial blood gas collected with a heparinized syringe and transported immediately for analysis. Observation was done till 72 hours of life at minimum. All Investigations were performed like blood sugar, serum ca^{+2}, ABG chest x-ray as & when necessary. Respiratory distress was monitored by Silverman's scoring.

Statistical Analysis:
Data was analyzed by using of statistical method with the help of MS-Office software.

Observations:
We were taken the total 110 neonates admitted in neonatal intensive care unit, intermediate care nursery and postnatal ward of Katihar Medical College, Katihar, Bihar, India. Out of 110 neonates 44 MAS neonates were clinically showing all three spectrum of severity i.e. mild, moderate and severe in both Ph characteristics of <7.2 and ≥7.2.

MAS patients in two groups were identical but the severity of MAS was more with PH status <7.2. Other parameters like antenatal checkups, Rate of caesarean section, IUGR characteristics and delay in 2nd stage of labour were almost identical between groups. Mean pH of the population of neonates in < 7.2 group was 7.07. Mean ph of the population of neonates of ≥ 7.2 group was 7.28. Mean PCO_2 of the population of neonates in pH < 7.2 was 49.6mmHg. Mean PCO_2 of the population of neonates in pH ≥ 7.2 was 45.6mmHg. Mean PO_2 of the population of neonates in pH < 7.2 was 24.9. Mean PO_2 of the population of neonates in pH ≥ 7.2 was 21.94. Mean APGAR score at 1minute in pH < 7.2 was 4.78. Mean APGAR score at 1minute in pH ≥ 7.2 was 6.37. Mean APGAR score at 5 minute in pH < 7.2 was 6.72. Mean APGAR score at 5 minute in pH ≥ 7.2 was 8.08. Mean amount of meconium below cord in two different pH status are 0.43 ml and 0.2 ml respectively. 13 cases (out of 36) i.e. 36.11% were shown no manifestation of MAS. 9 cases (out of 36) i.e. 25% were shown mild MAS. 8cases (out of 36) i.e. 22 .2% were shown moderate MAS. And rest 16.66% cases were shown severe MAS . 49 cases (out of 74) i.e. 66% were shown no clinical manifestation. 18 cases (out of 74) i.e. 25% were shown mild MAS. 5 cases (out of 74) i.e. 6.7% were shown moderate MAS. 2case (out of 74) i.e. 3% were shown severe MAS.

Table.1, Final outcome at different umbilical artery PH.

Outcome	Umbilical Artery PH		Total
	pH <7.2	pH ≥ 7.2	
Expired	3	2	5
Improved	29	72	101
LAMA	4	0	4
Total	36	74	110

29 (80.56%) neonates were improved in group of pH<7.2. 4 (11.11%) neonates were LAMA in group of pH< 7.2. And 3 (8.33%) neonates were expired in group of Ph < 7.2.

72 (97.3 %) neonates were improved in group of Ph ≥7.2. And 2 (2.7 %) neonates were expired in group of pH ≥ 7.2.

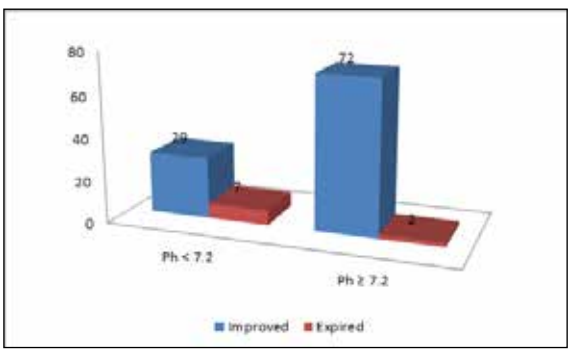

Figure.1. Overall survival and mortality in two different PH status.

Discussion:
In this study, Demographic parameters in the severity of different spectrum were almost same. Only the parameter that really matter was the extent of acidosis. 63.8% neonates were clinically respiratory distress in group of pH < 7.2. And 32.8% were respiratory distress in group of pH≥7.2.

A study, conducted by Sean C. Blackwell et al.[10]They were compared the identical demographic and antenatal characteristics of two groups of neonates on either side of PH. They were got significant different in the variables, APGAR, umbilical artery PH, Umbilical artery PCo_2 tension and umbilical artery base excess and they were statistical significant.

In our study we were seen that the severity of respiratory distress was more in the PH group <7.2. Hypoxia-asphyxia that was more contributory rather than meconium, it may causes severe distress.

Acidosis may owing to severe hypoxia in utero that causes the subsequent distress. Rossi et al[11] were noted, fetal heart rate abnormalities cesarean delivery for fetal indications, and fetal acidemia occurred more often with meconium aspiration syndrome.

Ramin et al[12] had reported an increase relationship between umbilical PH at delivery and the risk of meconium aspiration syndrome in neonate delivered through meconium stained amniotic fluid. However in this same study 55% of all cases of meconium aspiration syndrome occurred with an umbilical PH≥7.2 on delivery. In fact, severe meconium aspiration syndrome may occur without acidemia at delivery.

In our study, there were two severe MAS case in normal PH status and the neonates were expired after 5th day. Sepsis was contributory to it.

Sunoo et al[13] were described 4 cases of severe meconium aspiration syndrome after elective cesarean delivery without any abnormal fetal heart rate pattern of evidence of fetal compromise.

Sean C. Blackwell[10] had also shown that normal acid base status at delivery is present in many cases of severe meconium aspiration syndrome suggesting that either a preexisting injury or a non-hypoxic mechanism is often involved.

We were observed the correlation of consistencies of meconium with se-

verity i.e. the distress. There was no exact statistical correlation to it.

The overall mortality i.e. 8.2% MAS in our study was due to severe respiratory distress (respiratory failure).

Severe acid base imbalance in the newborns' cord blood were observed in those pregnancies where delayed in delivery of head especially when, deliveries were conducted at primary health centers, there was delayed in induction or failed induction, growth retardation, maternal medical illness like pre-eclampsia or eclampsia. Severe acidosis was observed in those conditions when early intervention like caesarean section or forceps application was not available in the rural setup and referrals hospital. Poor maternal education, poor antenatal care. Intrauterine growth restrictions, prolonged second stage of labour were prime cause of poor outcome in newborns.

Future Research:
Science is dynamic and there is always a scope of improvement and change in time to come ahead. With progressive aim to move ahead we aspire to achieve highly accurate and reliable results. Thus every study leaves back scopes for other researcher to do something more advanced and varied in order to touch the height of perfection. This study examined only 110 subjects, future researchers can expand the study by including more number of subjects so as to make generalization of the results and practice, further studies with a larger sample size and in multiple centers are required. Thus it could be applied to real life situation.

Relevance to clinical practice:
All the MAS (Meconium Aspiration Syndrome) cases may require immediate umbilical arterial cord blood pH monitoring after delivery.

Limitation:
There were several limitations like, the sample size was small, and unavailability of ABG reagents.

Summary:
Severity of respiratory distress wass more with umbilical arterial PH status < 7.2 i.e. clinical features manifesting MAS was more in this PH status. Mortality of neonates were more with PH status < 7.2. Among the population of newborn taken under study fulfilling the criteria of study. 40% neonates were shown show features of MAS either mild, moderate or in severe form. Severity of MAS was not depend on the consistencies of meconium. Overall mortality was 8.2%.

Conclusion:
Severity of MAS was more with Umbilical Arterial PH status < 7.2 and mortality was also more with this PH status. Prognosis with severe acidosis was poor. Severity was not depend on the different consistencies of meconium.

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