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Original Article

Factors Leading to Meconium Aspiration Syndrome in Neonates

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Abstract

Background: To determine the factors leading to meconium aspiration syndrome in neonates

Methods: In this descriptive study 100 neonates, with complaint of meconium staining of body, vocal cords and / or respiratory distress, whether delivered at home or at hospital, were included. Babies were first diagnosed as a case of meconium aspiration syndrome by meconium staining of body and vocal cords, and / or tachypnea and respiratory distress. They were examined for crepitations in chest on auscultation. Chest X-rays were done of all patients to see infiltrates and hyperinflation.

Results: The most frequent factor was birth asphyxia which was predicted by poor APGAR score (40% cases). The other factor was post term pregnancy(30%). Males constituted 58%and 42% were females. One patient (1%) case was preterm and IUGR. While 30% cases were post-term and 69% cases were born by appropriate age. 60% cases were delivered by spontaneous vaginal delivery. Commonest complications observed were pneumothorax (15%) and sepsis. Chest X-Ray findings showed infiltrates and hyper expansion in 50% cases.

Conclusion: Factors which lead to meconium aspiration syndrome are birth asphyxia, post term pregnancy, maternal diseases, prolong labour and IUGR.

Key Words: Meconium aspiration syndrome, Neonate, Pneumothorax

Introduction

Meconium aspiration is a disease of term and post term newborn babies. This illness follows the inhalation of meconium before, during or immediately after delivery[1].During prolonged and difficult deliveries, infant often initiate vigorous respiratory movement in utero because of interference with the supply of oxygen through the placenta. Under these circumstances, infant may aspirate amniotic fluid or meconium. This may be drawn into upper respiratory airway and into respiratory tree.[1-3] As a result of meconium aspiration, small airway obstruction may occur; it may produce respiratory distress within first hour, tachypnea, respiratory grunting and cyanosis in severely affected infants.[1,2]In the presence of asphyxia and meconium stained liquor with a change in fetal heart rate and fall in fetal scalp pH, delivery should be expedited by forceps or by caesarean section, if significant meconium aspiration syndrome (MAS) to be prevented. In the presence of fetal distress, infants born with meconium but otherwise vigorous, they do not require intubation; only require suction, oxygen and monitoring. Depressed infants (those with hypotonia, bradycardia or apnea) and those delivered through thick fluid should undergo endotracheal intubation and suction should be applied directly to endotracheal tube to remove meconium from airway.[2] For treatment, oxygen is needed. Supportive ventilation is needed in some cases, when required it is often necessary to use high inflation pressure.[4]Extracorporeal membranes oxygenation (ECMO) is used in severe disease. ECMO has been used in many infants, with about 80% survival reported.[2,4]There is evidence that meconium aspiration increases the risk of secondary bacterial infections and therefore antibiotics such as penicillin and gentamycin should be prescribed. Meconium aspiration syndrome is one of the important causes of neonatal respiratory problems and eventually leading to increased neonatal morbidity and mortality. Important complications include respiratory failure, air leaks (Pneumothorax, pneumomediastinum), pulmonary hypertension and bacterial pneumonia.[5] These causes then eventually lead to increase mortality in these children. Apart from death due to meconium aspiration syndrome, there are other co-morbid conditions like birth asphyxia and certain therapeutic interventions like assisted ventilation are causes of increased morbidity and mortality in MAS. Therefore, it can be said that morbidity and mortality in MAS is not only because of

meconium inhalation but also depends upon co-morbid conditions and therapeutic interventions.[6]

Patients and Methods

The neonates who presented to us in Paediatric department Nishtar Hospital, Multan with complaint of meconium staining of body, vocal cords and / or respiratory distress, whether delivered at home or at hospital. Babies were first diagnosed as a case of meconium aspiration syndrome by meconium staining of body and vocal cords, and / or tachypnea and respiratory distress. The informed consent was taken from parents/attendants and risks and benefits of study were fully explained. The permission from ethical committee was taken. They were examined for crepitations in chest on auscultation. Chest X-rays were done of all patients to see infiltrates and hyperinflation. Then detailed history taken and baby examined and necessary investigations were done. So after fulfilling eligibility criteria MAS Positive cases were included in study.Questions were asked regarding gestational age, (which was calculated from last date of menstrual period. H/o Diabetes in mother, H/o hypertension in mother and medications, History of prolong labour / and difficult labour (if it was > 18 hrs.). Also resuscitation record seen for APGAR score at 5 min. H/o delayed cry or no cry and grunting asked. H/o ante-natal follow up and ultrasonographic reports were seen. H/o maternal diseases like diabetes pulmonary diseases like asthma, COPD and cardiac disease and renal disease were asked. Age of baby, mode & place of delivery and H/o resuscitation were asked. Vitals were noted by staff nurse/doctor, chest auscultated, and general physical examination done. Babies were examined and assessed for complications such as Pneumothorax, respiration failure, atelectasis and sepsis. These babies were also judged for mortality causes like sepsis, Pneumothorax.Chest X-rays were done to see hyperinflation, infiltrate and atelectasis.

Results

In this study 100 patients with meconium aspiration syndrome were observed in first 7 days of their life. The commonest factor was birth asphyxia which was predicted by poor APGAR score (40% cases). Out of these 40 patients, in 30 cases asphyxia was more than 5 hours duration while in 10 cases it was <2 hours duration. Other factors were post maturity , intrauterine growth retardation, maternal hypertension, diabetes and prolonged labour (Table 1). One patient (1%) was preterm and IUGR. While 30% cases were post-term and 69% cases were born by appropriate age(Table 2). Most of the patients were delivered by spontaneous vaginal delivery 60% cases (Table 3).Low birth weight i.e. <2.5 Kg were 10% and children with weight between 2.5-3.5 kg were 75% and having weight 3.5 -4Kg were 10% and > 4kg 5% (Table 4). The complications were observed like pneumothorax (15%), sepsis (20%), Atelectasis (10%) and respiratory failure (8%) (Table 5). There were also certain associated problems like convulsions in patients due to birth asphyxia in 15% cases. Chest X-Ray findings in these patients showed infiltrates and hyper expansion in 25% cases, diffuse infiltration in 50% cases, pneumothorax in 15% cases and atelectasis 10%. In this study most of the patients presented in1st few hours of life(90% cases) .while 10% cases presented at 1st, 2nd, 3rd, and 4th day of life. Mortality was 20%. Ten cases died due to Pneumothorax and 10 to sepsis and pneumonia.

Table 1.Facters leading to meconium aspiration syndrome (n=100)

Risk factor	No	Percentage
Birth Asphyxia	40	40.0
Post maturity	30	30.0
Intra uterine growth retardation (IUGR)	8	8.0
Maternal hypertension	10	10.0
Diabetes	4	4.0
Prolonged labour	4	4.0
Chronic Maternal Disease (Asthma)	2	2.0
No obvious factor found	2	2.0

Table 2.Distribution of patients suffering from meconium aspiration syndrome regarding gestational age

Gestational	No	Percentage
<37 weeks	1	1.0
37-42 weeks	69	69.0
>42 weeks	30	30.0

Table 3.Mode of delivery in newborns with meconium aspiration syndrome

Mode of delivery	No	Percentage
Spontaneous vaginal delivery	60	60.0
Caesarean Section	36	36.0
Forceps delivery	4	4.0

Table 4. Birth weight among newborns with meconium aspiration syndrome

Mode of delivery	No	Percentage
<2.5kg	10	10.0
2.5-3.5kg	75	75.0

3.5-4.0kg	10	10.0
>4kg	5	5.0

Table 5.Complications found in newborn due to meconium aspiration syndrome

Complication	No	Percentage
Pneumothorax	15	15.0
Sepsis	20	20.0
Atelectasis	10	10.0
Respiratory failure	08	08.0

Discussion

Meconium aspiration syndrome (MAS) is a problem found all over the world. There is substantial mortality and morbidity considerably by this disease. Post maturity is one of the major factor which lead to meconium aspiration syndrome. In this study 30% cases of patients were post-mature also showed in a study done in South Africa by Adhikasi.[7] In this study poor APGAR score ≤3/10 at 1 and 5 minutes was found in 40% cases who have meconium aspiration syndrome. It is relatively similar to that found by Gerald et al.[8] It was seen that poor APGAR score was due to ante-natal and natal causes of birth asphyxia and in some cases was due to pharyngeal suction and endotracheal intubation by paediatrician.

In present study intrauterine growth retardation(IUGR) was found associated with poor maternal diet and chronic diseases, like hypertension, diabetes etc. In other studies it was also found 6-10% cases of IUGR result in MAS.[9] Maternal hypertension is an important factor which leads to multiple fetal and maternal complication. It may be essential HTN or pregnancy induced hypertension. If it is not properly controlled, leads to growth restriction of fetus and also in our study 10% cases were with meconium aspiration syndrome. Majority of these women were not on regular anti-hypertensive therapy and not on follow up visits to obstetricians or physicians. Prolong and difficult labour was also seen as a factor resulting in MAS in 4% cases and all of these babies were delivered with forcep's delivery. This prolonged labour resulted in utero fetal distress and ultimately passage of meconium by babies.. 4% of meconium aspiration cases were IDM. These mother were not on regular follow up and diabetes was not controlled in these mother. These babies had no other associated congenital problems. The weight of these babies was >4 kg and these babies also showed hypoglycemia. Only 2% cases of meconium aspiration were associated with chronic maternal disease. These mothers have bronchial asthma which was not controlled and they were categorized as having moderate degree asthma and these mothers had irregular follow ups and belonged to poor families. No case of cardiac, or renal disease was observed in this study. In 2% cases of meconium aspiration syndrome, no obvious factor was observed.

As far as percentage of patients who needed ventilatory support, is quite different, in studies done everywhere e.g. in America 18/100 deliveries of meconium aspiration syndrome needed ventilation.[10] According to a study done in South Africa by Herhandez C et al 48% needed ventilatory support.[11] In present study 08% patients, who went into respiratory failure, needed ventilatory support. Although this result is quite near to former study but quite lower than study done at South Africa, its reasoning is that in our unit there are only limited ventilators, though much of the patients than those we put on ventilator required assisted ventilation because of limited resources.

There were 15% of the patients having pneumothorax as a complication in present study; however in another study done at Lahore, incidence of pneumothorax was 8%.[12] Here again our study differ from above study, it could be because of decrease use of assisted ventilation (i.e. ventilators) due to lack of proper and sufficient resources, because pneumothorax, is much more found in these children who required assisted ventilation, and in meconium aspiration syndrome high peak end expiratory pressure (PEEP) is required. Other probable reason is that our large number of population lived in rural areas, where health facilities are quite short and they also have limited transport facilities to come in tertiary care hospitals.

A study from Lahore concluded that combined obstetric intervention (caesarean section) and paediatric intervention (laryngoscopy, tracheal intubation, suction, immediate transfer to nursery) lead to reduced severity of meconium aspiration syndrome and hence low mortality. [13]

In about 15% children convulsion were found, cause was hypoglycemic (random blood sugar <50 mg/dl) in 2 children and remaining 13 cases, it was associated birth asphyxia, which was found due to cerebral edema seen through cranial ultrasound.

Much of the patients delivered by spontaneous vaginal deliver 60 cases (60%), however, significant number of patients requires caesarean section to be delivered 36 (36%). Study done by Haque MA observed caesarean section in 46%. This high percentage of caesarean section delivered children is probably poor antenatal monitoring of risk factors,

that not only leads to MAS but also put the fetus on fetal distress and by the time, these pregnancies approach tertiary care unit, these fetus are in severe distress and at the moment their safe mode of delivery is caesarean section chosen by our obstetricians. In 4% cases forcep's delivery was done.[12]

As for as the severity of MAS is concerned, nulliparity, fetal tachycardia, and intrapartum fever were significantly increased in the mild/moderate MAS group. While a longer duration of the second stage of labor was significantly associated with mild/moderate MAS, severe MAS was associated with a shorter duration of the second stage.[14] While acute tocolysis, increased c-section rates, fetal distress, and asphyxia were associated with severe MAS in other studies.[15,16] Another study conducted in India also concluded that fetal distress, prolonged labor, and absent/poor cry predicted respiratory distress and MAS.[17] While severity of meconium, low Apgar score at 5 min and non-reassuring FHR tracing was associated with MAS in Meconium Stained Amniotic Fluid pregnancies was concluded by an Irani study.[18]Inflammatory markers also play role in severity of MAS.[19] Intrapartum oropharyngeal suction has no role in prevention of Meconium aspiration and its severity.[20] Infants with MAS also develop persistent pulmonary hypertension which alone is a major co-morbid risk factor.[21]Avoidance of asphyxia and pneumothorax might be the key to reduce the incidence of PPNH and mortality rate of MAS.[22]Male gender, caesarean section mode of delivery, MAS and RDS are the major risk factors for PPHN in any age group while RDS, Birth asphyxia and male sex are associated with increased risk of mortality in pre-term than term and post term infants.[23]MAS and its severity is also linked to ethnicity and the increased use of innovative respiratory supports has not altered the duration of mechanical ventilation.[24]Meconium-stained Amniotic Fluid rates are different among races and across gestational age as evident by UK study.[25]Rajput U et al. (2013)19 in their study found that perinatal mortality was mainly associated with thick meconium and severe birth asphyxia.[26] One third of infants with MAS require intubations and mechanical ventilation.[27] Surfactant use does not appear to affect mortality rates, it may reduce the severity of disease, progression to extracorporeal membrane oxygenation (ECMO) utilization and decrease the length of hospital stay.[28]The guidelines are under continuous review and are revised as new evidence-based research becomes available. The seventh edition of the Neonatal Resuscitation Program modified its previous recommendations regarding endotracheal suctioning for the no vigorous infant.[29,30]Surfactant therapy is commonly used to replace displaced or inactivated surfactant and as a deterrent to remove meconium.[31] Current recommendations no longer advise routine intrapartum suctioning for infants born to mothers with meconium staining of the amniotic fluid.[32]The American College of Obstetricians and Gynecologists (ACOG) continues to provide guidance regarding the appropriate indications for delivery to prevent neonatal complications of a prolonged pregnancy, as well as for avoiding the unnecessary delivery of a preterm baby.[33]Meconium stained amniotic fluid is comparatively more common in primi gravidas when compared to multi gravidas.[34]When parity is concerned, half of the mothers(50%) who delivered MAS babies were having primigravida unlike study by V.Gupta who found that there is no association between MSAF and parity.[35]

In present study it was found that large numbers of children have associated birth asphyxia as judged by poor Apgar score probably this birth asphyxia is the major risk factor for meconium stained amniotic fluid and also aspiration. However, this birth asphyxia was the result of those antenatal risk factor i.e. maternal hypertension, maternal diabetes mellitus and IUGR, which were not properly addressed because of lack of knowledge and facilities.

Conclusions

1. Meconium aspiration is one of the important clinical entity and different avoidable factors leads to meconium aspiration syndrome.
2. The most frequent factor which leads to MAS is birth asphyxia, which may be due to ante-natal and natal causes and it can be avoided, if proper ante-natal check up is done and good obstetric and delivery care is provided.
3. Intensive care and neonatal resuscitation should be provided to the newborns with above mentioned factors. Preferably paediatrician should attend such deliveries. So that morbidity and mortality can be reduced.

References

1. Khan PA.Meconium aspiration syndrome. Basis of Paediatrics.7th ed. Multan: Nishtar Books;2008:141-81.
2. Peter A, Dargaville PA, Copnell B. The epidemiology of meconium aspiration syndrome: Incidence, risk factors, therapies and outcome. Pediatrics. May 2006;5(117):1712-21.
3. Ramin KD, Leveno KJ, Kelly MA. Amniotic fluid meconium: a fetal environmental hazard. J ObstetGynaecol 1996;87:181-84.
4. Gold G, Dudell, Stoll BJ. Respiratory tract disorders. In: Behrman RE, Kliegman RM, Jenson RM, editors. Nelson text book of paediatrics. Philadelphia: Elsevier; 2008: 742-44.

5. Singh BS, Clark RH, Powers RJ. Meconium aspiration syndrome remains a significant problem in the NICU: outcomes and treatment patterns in term neonates admitted for intensive care during a ten-year period. J Perinatol. 2009;29(27):497-503.
6. Palrdottirk, Daqbjartsson A, Thorkellson T, Hardantottson H. Birth Asphyxia and hypoxic ischemic encephalopathy, Incidence and obstetric risk factors. Laeknablandid 2007;93(9):595-601.
7. Adhikari M. Meconium aspiration syndrome: importance of the monitoring of labour. J Perinatal 1998;18:55-60.
8. Berdeli A, Akisu M, Dagci T. Meconium enhances platelet activating factor and tumor necrosis factor production by rat alveolar macrophages. Ada Paediatr 2000;93:5-7.
9. Wong SF, Chow KM, HOLC.The relative risk of 'fetal distress, in pregnancy associated with meconium stained liquor at different gestation. J Obstet Gynaecol 2002;22(6):594-99.
10. Janseen DJ, Carnielli VP, Cogo P. Surfactant phosphatidylcholine metabolism in neonates with meconium aspiration syndrome. J Pediatr. Nov 2006;149(5):634-39 .
11. Hemandez C. Prediction of the severity of meconium aspiration syndrome. Am J Obstet Gynecol 1993;169:61-70.
12. Haque MA. Risk factors and outcome of meconium aspiration syndrome. Dissertation for FCPS 1999.
13. Chishty AL, Alvi Y, Bhutta TI. Meconium aspiration in neonates: combined obstetric and paediatric intervention improves outcome. J Pak Med Assoc 1996;46:104-08.
14. Hofer N, Jank K, Resch E, Urlesberger B, Reiterer F, Resch B. Meconium aspiration syndrome--a 21-years' experience from a tertiary care center and analysis of risk factors for predicting disease severity. KlinPadiatr 2013 ;225(7):383-88.
15. Choi W, Jeong H, Choi SJ, Oh SY, Kim JS. Risk factors differentiating mild/moderate from severe meconium aspiration syndrome in meconium-stained neonates. ObstetGynecol Sci. 2015 Jan;58(1):24-31.
16. Osava RH, Silva FM, Vasconcellos de Oliveira SM. Meconium-stained amniotic fluid and maternal and neonatal factors associated. Rev Saude Publica. 2012;46(6):1023-29.
17. Singh SN, Srivastava R, Singh A, Tahazzul M, Kumar M, Kanta C. Respiratory distress including meconium aspiration syndrome in vigorous neonates born through meconium stained amniotic fluid: incidence, onset, severity and predictors at birth. Indian J Pediatr 2013 ;80(7):538-43.
18. Khazardoost S, Hantoushzadeh S, Khooshideh M, Borna S. Risk factors for meconium aspiration in meconium stained amniotic fluid. J Obstet Gynaecol. 2007 ;27(6):577-79.
19. Hofer N, JankK, Strenger V, Pansy J, Resch B. Inflammatory indices in meconium aspiration syndrome. Pediatr Pulmonol. 2016 ;51(6):601-06.
20. Nangia S, Pal MM, Saili A, Gupta U.Effect of intrapartum oropharyngeal (IP-OP) suction on meconium aspiration syndrome (MAS) in developing country: A RCT. Resuscitation. 2015 Dec;97:83-87.
21. Lee EC, Choi MG, Shim GH, Song YH, Chey MG. Comorbid risk factors of persistent pulmonary hypertension of the newborn in infants with meconium aspiration syndrome. Neonatal Med 2014;21(3):166-71.
22. Hsieh TK, Su BH, Chen AC, Lin TW, Tsai CH. Risk factors of meconium aspiration syndrome developing into persistent pulmonary hypertension of newborn. ActaPaediatr Taiwan 2004 ;45(4):203-07.
23. Razzaq A, Quddusi AI, Nizami N. Risk factors and mortality among newborns with persistent pulmonary hypertension. Pak J Med Sci 2013; 29(5): 1099–1104.
24. Dargaville PA, Copnell B. The epidemiology of meconium aspiration syndrome: incidence, risk factors, therapies, and outcome. Pediatrics 2006 ;117(5):1712-21.
25. Balchin I, Whittaker JC, Lamont RF, Steer PJ. Maternal and fetal characteristics associated with meconium-stained amniotic fluid. Obstet Gynecol 2011 ;117(4):828-35.
26. Rajput U, Jain A. Impact of meconiumstained amniotic fluid on early neonatal outcome. JEMDS 2013; 2(45):8788-94.
27. Mehar V, Agarwal N, Agarwal A, Agarwal S. Meconium- stained amniotic fluid as a potential risk factor for perinatal asphaxia. J Clineonatol 2016; 5:157-61.
28. El Shahed Al, Dargaville PA, Ohlsson A, Soll R, Surfactant for meconium aspiration syndrome in term and late preterm infants. Cochrane Database system Rev. 2014 . CD002054.
29. Wyckoff MH, Aziz K, Escobedo MB. Neonatal resuscitation 2015 American Heart Association guidelines update for cardiopulmonary resuscitation and emergency cardiovascular care. Circulation 2015; 132 (18):543-60.
30. American College of Obstetricians and Gynecologists. ACOG Committee opinion no. 689 summary: delivery of a newborn with meconium-stained amniotic fluid. Obstet Gynecol 2017 ; 129 (3):593-95.
31. Dargaville PA.Innovation in surfactant therapy I: surfactant lavage and surfactant administration by fluid bolus using minimally invasive techniques. Neonatology 2012; 101 (4):326-36.
32. Chettri S, Bhat BV, Adhisivam B. Current concepts in the management of meconium aspiration syndrome. Indian J Pediatr 2016; 83 (10): 1125-30.
33. American College of Obstetricians and Gynecologists. ACOG Committee opinion no. 579: definition of term pregnancy. Obstet Gynecol 2013; 122 (5):1139-40.
34. Anjali Soni, Gunvant D Vaishnav, JagdishGohil. Meconium and its Significance and Obstetric Outcome.Med-Science2015; 4(1):117-20
35. Gupta V, Bhatia BD, Mishra OP. Meconium stained amniotic fluid: antenatal, intrapartum and neonatal attributes.Indian Pediatr. 1996 ;33(4):293-97