

Evaluation of Impact of Perinatal Factors on Time to First Meconium Passage in Nigerian Neonates

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Abstract

Background

Delayed meconium passage is usually a signal to congenital distal bowel dysfunction. Timing of meconium passage may vary depending on race, sex and several perinatal factors. Understanding the timing and associated perinatal factors in any given population will help in prompt diagnosis and adequate management of cases in that population.

Objectives: To determine the timing of first meconium passage amongst Nigerian neonates, and evaluate the impact of various associated perinatal factors.

Materials and Methods

A cross-sectional study using interviewer-administered questionnaires to obtain data from mothers of apparently normal infants attending the postnatal clinic of the University of Nigeria Teaching Hospital, Enugu, Nigeria. Data acquisition and analysis were done using SPSS version 20. A P-value of < 0.05 was adjudged statistically significant.

Results

There were 276 male and 277 female infants. Mean birth weight was 3.4kg and mean gestational age at delivery 38.8weeks. The median age at presentation was 42days. Preterm deliveries were in 6.3%(32/510) and 3.7%(20/536) weighed less than 2.5kg at birth. Sixty-five percent (339/519) had spontaneous vertex delivery and 35%(180/519) had caesarean delivery. Passage of first meconium was within 24hours in 56.6%(307/543) and in 48hours 91.3%(496/543) had passed meconium. Fifty-four percent (54%, 288/537) commenced breastfeeding within 24hours and 85% (n=456/537) within 48hours. Exclusive breastfeeding was done in 61.5%(326/533) of subjects. Timing of first meconium passage was significantly affected by gestational age at delivery ($p<0.001$), mode of delivery ($p<0.01$), birth weight ($p=0.02$), first minute APGAR score ($p<0.001$), timing of commencement of breastfeeding ($p<0.001$) and feeding before breastfeeding is commenced ($p = 0.02$).

Conclusion

Compared to other studies, we found smaller proportion of neonates passing meconium in the first 24 hours. Term neonates, birth weight ≥ 2.5 kg, spontaneous vertex delivery, high Apgar score, commencement of breastfeeding within 24 hours of birth, feeding before breastfeeding is commenced, are perinatal factors associated with earlier first meconium passage.

Key words: Evaluation, Impact, Perinatal Factors, First meconium passage, Neonates

Introduction

Meconium is the odourless earliest stool passed by a neonate after delivery. It is composed of desquamated intestinal epithelial cells, exfoliated lanugo, mucus, amniotic fluid, bile, and water. Timing of first meconium passage is a good pointer to distal colonic function in a neonate and delayed passage of meconium usually is a signal to congenital distal bowel dysfunction like Hirschsprung's disease (HD), anorectal malformation, distal intestinal atresia, prematurity, hypothyroidism, etc. Various western studies have suggested that more than 90% of neonates pass meconium within the first 24 hours of life. In Sherry et al¹ it was 94%, Clark et al² 98%, Loening-Baucke et al³ and Gommel et al⁴ 99%. Hence, they defined delayed passage of meconium as passage of meconium beyond 24 hours of delivery. It has also been suggested that such term neonates with first passage of meconium beyond 24 hours should be monitored and investigated. Some studies from Africa, especially Nigeria,

however, have shown that less proportion of neonates pass meconium in 24 hours. Ameh et al⁵ noted 76%, Okoro et al⁶ 81% and Omoigberale et al⁷ 88%. In these African studies 92%-99% have passed meconium by 48 hours without any adverse effects^{5,6}. Definition of delayed meconium passage as first meconium passage beyond 48 hours of age instead of beyond 24 hours is therefore being proposed by some of these African researchers⁵. However, there is insufficient data to support this proposal for the African population. For the term and post-term neonates, this redefinition may help to avert unnecessary investigations which are costly and expose patients to various potential complications^{8,9}. Many factors have been purported to have impact on timing of first meconium passage and may include race, gestational age at birth, birth weight, method of delivery, respiratory distress syndrome, timing of commencement of breastfeeding, and timing of first feeds other than breast milk. Understanding the timing of first meconium passage

and the impact of various perinatal factors on this timing in any given population will help in counseling parents and guardians as well as encourage prompt diagnosis and early appropriate management of cases of delayed first meconium passage. Furthermore over-diagnosis will be prevented and undergoing unnecessary investigations averted. In this study we aimed to evaluate the proportion of neonates who pass meconium in the first 48 hours of life, and also assess the effects of sex, ethnicity and various perinatal factors on the time to first meconium passage. We define early passage of meconium as passage of meconium within 48 hours of life and delayed passage of meconium as passage of meconium beyond 48 hours of life.

Materials and Methods

A cross-sectional study using interviewer-administered questionnaires was done to obtain data consecutively from mothers of apparently normal infants at the postnatal wards, immunization clinic, and postnatal clinics of the University of Nigeria Teaching Hospital (UNTH), Enugu, Nigeria from November 2014 to October 2016. Information on sex of the neonates, gestational age at birth, birth weight, mode of delivery, first and fifth minute APGAR scores, first time of passage of meconium, time of commencement of breastfeeding, any feeding before commencement of breastfeeding were obtained from the mother and the hospital's antenatal and postnatal records. The mothers were asked to recall timing of various events in 24 hour intervals as recall of smaller time intervals may be more difficult and less accurate. Data were initially acquired using the interviewer administered questionnaires and later transferred to SPSS version 20 (SPSS Inc. Chicago Illinois) for analysis. Results were presented as means ± SD, ranges, percentages, tables and statistical analysis done using Fisher's exact test for categorical variables. A p-value of <0.05 was adjudged statistically significant.

Table 2. Timing of first meconium Passage

	Number	Percentage
Within 24hours	313	56.6
24-48hours	192	34.7
48-72hours	44	8.0
>72hours	4	0.7
Total	553	100

Table 3: Association between some perinatal factors and timing of first meconium passage

	First meconium passage within 48hours	First meconium passage after 48hours	p-value	Odds ratio	95% CI
Gestational Age Preterm Term	21 446	11 32	< 0.0001	0.14	0.06 – 0.31.
Mode of Delivery Spontaneous vertex Delivery Caesarean Section	320 155	19 25	< 0.01	2.72	1.45-5-.08
Birth Weight < 2.5Kg ≥2.5Kg	15 466	5 40	0.01	0.26	0.09-0.75
APGAR Score First Minute <7 ≥7	25 287	10 22	< 0.001	0.19	0.08-0.45
APGAR Score fifth minute <7 ≥7	5 301	4 28	< 0.01	0.12	0.03-0.46
Feeding before breastfeeding? Feeding No Feeding	264 205	35 12	0.02	0.44	0.22-0.87
Commencement of Breastfeeding Within 24hours Beyond 24hours	277 207	10 36	< 0.0001	4.81	2.34-9.93
Ethnicity Igbo Non-Igbo	394 38	88 9	0.88	1.06	0.49-2.27
Sex Male Female	251 245	19 28	0.18	1.51	0.82-2.77

Table 1: Socio-Demographic Characteristics of Infants

Mean Birth Weight Less than 2.5kg Greater than or equal to 2.5kg	3.37±0.53kg 20 516	3.7% 96.3%
Mean Age Median age	31.61±23.08 days 42 days	
Mean gestational age at delivery Preterm Term	38.8 ± 1.58 weeks 32 478	6.3% 93.7%
Mode of delivery Spontaneous Vertex Delivery Caesarean section	339 180	65% 35%
First minute APGAR Score <7 ≥7	37 313	10.6% 89.4%
Fifth Minute APGAR <7 ≥7	10 234	4% 96%
Sex Males Females	275 276	49.9% 50.1%
Ethnicity Igbos Non-Igbos	442 97	82% 18%

Results

There were 553 infants (276 males and 277 females). Birth weight ranged from 1.5kg to 6kg (mean: 3.37±0.53). Gestational age at birth ranged from 31-42 weeks (median: 39 weeks, mean: 38.8± 1.59 weeks). The median age at presentation was 42 days and the modal age was 42 days. Preterm deliveries were seen in 6.3% (32/510) and 3.7% (20/536) weighed less than 2.5kg at birth. Sixty-five percent (339/519) had spontaneous vertex delivery and 35% (180/519) had caesarean delivery. Passage of first meconium was within 24hours in 56.6%(307/543); within 48 hours in 91.3%(496/543) and within 72hours in 99.3% (539/543) had passed meconium. Fifty-four percent (54%, 288/537) commenced breastfeeding within 24 hours and 85% (n=456/537) within 48 hours. Exclusive breastfeeding was done in 61.5% (326/533) of subjects) of subjects. Timing of first meconium passage was significantly affected by gestational age at delivery (p<0.001), mode of delivery (p<0.01), birth weight (p=0.02), first minute APGAR score (p<0.001), fifth minute APGAR score (p=0.006), timing of commencement of breastfeeding (p<0.001) and feeding before breastfeeding is commenced (0.02). The timing of first meconium passage was not significantly affected by sex (p=0.22) and ethnicity (p=0.84).

Discussion

In some African studies, delayed passage of meconium is being suggested as delay in meconium passage beyond 48 hours of delivery in term neonates⁶. This is because a large proportion of apparently normal neonates pass meconium after 24 hours but within 48 hours of delivery. The percentage of African infants passing meconium within 24 hours of birth ranged from 76%-88%^{5,6,7}. This is opposed to Western studies mostly defining delay as passage of meconium beyond 24 hours and in these studies the percentage that passed meconium in 24 hours ranged from 94%-99%^{1,2,3,4}. In the present study all apparently normal neonates, including preterm infants, were studied and only 56.6% of the neonates passed meconium in 24 hours and 91.3% in 48 hours. This supports other studies in Africa^{5,6,7} and we believe that defining delayed passage of meconium, as passing meconium beyond 48 hours should be more plausible in our environment. The study also supports other Nigerian studies showing that the percentage of Nigerian newborns passing meconium in 24 hours is quite smaller than generally accepted Western figures and hence using 24 hours as bench mark may classify a large percentage of newborns as having delay in meconium passage leading to parental anxiety and instituting unnecessary investigations with attendant risks of procedural complications^{8,9,10}. We therefore recommend that clinicians should only re-evaluate newborns for delayed meconium passage if they have not passed first meconium beyond 48 hours.

Comparing the results of the present study with some previous reports is difficult because of heterogeneity in their study designs including category of infants (preterm and/or term), definition of delayed passage of meconium, birth weight categorization (less than 1kg, less than 2.5kg or \geq 2.5kg), etc.

In preterm and low birth weight neonates many pass meconium beyond 24 hours. Similar to the present study, Jhaveri and colleagues¹¹, while studying preterm infants weighing less than or equal to 1500g, defined delayed passage of meconium as passing meconium after the first 48 hours of life. Delayed passage was noted in 20.4% of preterm neonates in the study. On the other hand, Wang et al¹² studying preterm neonates weighing \leq 1500g defined delayed passage as not passing meconium beyond 24 hours of life and found that 22.5% of preterm neonates passed meconium beyond 24 hours. Furthermore, Verma et al¹³ studied preterm neonates weighing less than or equal to 1000g and found that median age at passage of the first stool was 3 days and 90% of the infants have passed stool by 12 days after birth.

In the present study, a significantly more number of neonates delivered by the spontaneous vaginal delivery passed meconium earlier than those delivered by caesarean section. This is supported by findings by Tateishi et al¹⁴ suggesting that infants born vaginally were more acidotic and passed first stool earlier when compared to those born by Caesarean section. However, Gulcan et al¹⁵ did not find a significant relationship between mode of delivery and time to passage of first meconium.

It was also observed in the present study that significantly more term and post-term neonates than preterm neonates passed meconium within 48 hours of delivery. Only sixty-five percent of those delivered at a GA $<$ 37 weeks (preterm) passed meconium within 48 hours while 93.3% of those

delivered at GA of \geq 37 weeks gestation passed meconium within 48 hours ($p < 0.001$). This finding is corroborated by other authors^{4,15,16} who documented that gestational age is significantly correlated with time of first stool passage. It is thought that term neonates pass stool earlier because there is increased gastrointestinal motility with advanced gestational age¹⁷. In preterm neonates there is immaturity of bowel function and absence of the triggering effect that enteral feeding has on gut hormones¹⁵. Metaj et al¹⁸ noted that gestational age was a significant factor in predicting time to first stool. Kumar SL et al¹⁹ also noted that the gestational age independently correlated with the timing of first stool.

In this study, significantly more neonates with birth weight \geq 2.5kg passed meconium within 48 hours of birth when compared with those weighing less than 2.5kg ($p=0.02$). Also those weighing less than 2.5kg (low birth weight) were significantly more likely to have delayed passage of meconium beyond 48 hours than those weighing 2.5kg or more ($p=0.02$). This is supported by Bekkali et al¹⁶ who suggested that delay in passage of meconium was significantly more in those with less than or equal to 2.5kg. Also Verma et al¹³ found that median age at passage of the first stool was 3 days in neonates weighing less than or equal to 1000g, and it took about 12 days for 90% of these neonates to pass meconium. Furthermore, Gommel et al⁴ noted an inverse relationship between birth weight and meconium passage while Okoro et al, in their study involving only term neonates emphasized that birth weight does not affect passage of meconium in term neonates. Gulcan¹⁵ also noted no significant relationship between birth weight and time to passage of first meconium. In very low birth weight infants, delay in the passage of the first stool is a common occurrence. This delay is probably due to physiological immaturity of the motor mechanisms of the gut, and lack of triggering effect of enteral feeds on gut hormones^{11,12}.

First minute APGAR score of less than 7 was significantly associated with delay in passage of meconium than those with first minute APGAR score of greater than or equal to 7 ($p < 0.001$). Furthermore fifth minute APGAR score of less than 7 was also significantly associated with delay in passage of meconium than those with fifth minute APGAR score greater than or equal to 7 ($p < 0.006$). This may be related with the report by Gulcan¹⁵ which noted that time of first stool passage was significantly later in newborns with respiratory distress syndrome (RDS) than in gestational-age-matched newborns without RDS. Newborns with RDS exhibit delayed gastric emptying and this can adversely affect gut motility²⁰ and subsequently time to first meconium passage. Wang et al¹² also noted significant differences between those with delayed passage and non-delayed groups for presence of severe respiratory distress syndrome. Jhaveri et al¹¹ noted that the presence of severe respiratory distress syndrome, may singly or in concert with other factors adversely affect gastrointestinal motility leading to delayed passage of meconium.

In the current study early commencement of breastfeeding within 24 hours of delivery was associated with earlier passage of meconium than those who commenced breastfeeding beyond 24 hours of birth ($p < 0.001$). Gulcan et al¹⁵ also noted that time to first enteral feeding was significantly correlated with time of first stool passage. In those who were fed with various feeds before the onset of breastfeeding meconium passage also occurred significantly earlier than in those

who were not fed before breastfeeding ($p=0.02$). Enteral feeding is thought to trigger secretion of gut hormones that are critical to secretory function of target organs like stomach, pancreas, and small intestine¹⁵. Wang et al¹² also noted significant differences between groups with delayed and non-delayed passage of the first stool in the time to first enteral feeding.

Various types of feeds were used before breast milk was introduced by the mothers including plain water, glucose water, artificial milk, coconut water. These feeds given before commencement of breastfeeding significantly improved meconium passage in this study ($p=0.02$). This finding is similar to report by Lucas²¹ which also observed that preterm newborns fed enterally were associated with significant postnatal rise in plasma motilin which might increase efficiency of intestinal motor function.

In the current study there was no significant difference in time to passage of meconium amongst the two sexes ($p=0.22$) and this is corroborated by other studies^{6,13,15}.

Limitations and strengths of the study

The major limitation of this study is maternal recall bias. Mothers who were interviewed at the postnatal clinic may not recall with certainty when their infants passed their first meconium and other perinatal events including initiation of breastfeeding and other feeds. Keeping all the mothers in the postnatal wards from birth till meconium is passed would have been a more objective and accurate way of obtaining these data but this would have prolonged the hospital admission with its attendant cost implications. Another limitation is the possibility of maternal use of some drugs which have been shown to affect neonatal gut motility and consequently timing of meconium passage e.g. magnesium sulphate, narcotics, and betamethasone¹⁵. This category of neonates ought to have been sought for and excluded from the study. Further limitation in this study is lack of follow-up of those infants with delayed passage of meconium.

A major strength of this study was its large sample size which allowed for sub-group analysis of certain variables such as preterm and term births, low and normal birth weights, etc. The data collection site included the postnatal wards and immunization clinics where data was obtained from mothers whose neonates were able to pass meconium before discharge or before attending the immunization clinics respectively. This no doubt reduced recall bias and increased the study's internal validity which was a major limitation of previous designs that limited data collection to the six weeks postnatal clinic visits.

Implications for further studies

Future studies should consider following up infants with delayed passage of meconium to see if there might be any future developments of adverse sequelae. Furthermore timing of first meconium passage should be studied in other African countries, as most of the quoted studies appear to be limited to the various regions of Nigeria^{5,6,7}.

Conclusion

Compared to other studies, we found smaller proportion of neonates passing meconium in the first 24 hours. Term neonates, birth weight ≥ 2.5 kg, spontaneous vertex delivery, high APGAR score, early commencement of breastfeeding within 24 hours of birth, feeding before breastfeeding is commenced are perinatal factors associated with earlier first

meconium passage. Clinicians should be aware of this low proportion passing meconium in 24 hours and associated perinatal factors whenever confronted with cases of delayed passage of meconium. Mothers should be counseled on the effect of early commencement of breastfeeding in early passage of meconium.

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Availability of data

The primary data that give credence to the findings of this study could be obtained from the corresponding author, upon reasonable request within a reasonable time from the time of publication.

Ethical considerations

All the participants were adequately counseled and their informed consent obtained before administering the questionnaires. Participation in this study was voluntary and the patients' information were handled with utmost confidentiality.

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