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RESEARCH ARTICLE

UMBILICAL ARTERY BLOOD pH IN MECONIUM STAINED AMNIOTIC FLUID

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ABSTRACT

Meconium stained amniotic fluid is a common occurrence in many deliveries. It was considered physiological as well as pathological. It is difficult to know when this meconium causes distress in the newborn. In this study we have attempted to correlate umbilical artery blood pH at birth and neonatal status in Meconium Stained Liquor (MSL). In the present study it was observed that 90.9% of babies in Grade 1 MSL group had a pH of >7.2, 68% of babies in grade 2 MSL group had pH >7.2 and 40% of babies with Grade 3 MSL had normal pH at birth. Out of the 62 patients studied, only 5% of babies born through grade 1 MSL required Neonatal intensive care unit(NICU) admission while 50% of babies born through grade 3 MSL required NICU admission,45% of babies with grade 2 MSL required NICU admission and this is statistically significant. The cord blood pH is a sensitive parameter to diagnose birth asphyxia and can be used in high risk cases as this may help to provide appropriate care to the newborn thus preventing neonatal mortality as well as morbidity.

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INTRODUCTION

Meconium is the name given to the substances that have accumulated in the fetal bowel during intrauterine life. Intrauterine meconium passage in near term or term foetuses has been associated with fetomaternal stress factors and or infection, whereas meconium passage in post term pregnancies has been attributed to gastrointestinal maturation (Ahhanya *et al*., 2005). The incidence of meconium stained amniotic fluid is around 10-12% (Garite *et al*., 2007). Meconium is not only a potential sign of fetal hypoxia but is also a potential toxin if the fetus aspirates it leading to meconium aspiration syndrome. Arterial and venous cord blood gases provide evidence of fetal oxygenation at birth and indirectly reflect oxygenation during labour. Umbilical cord blood pH analysis immediately after delivery is the most objective way of assessing the fetal metabolic condition at birth. In accordance with the SOGC "Attendance at Labour and Delivery Guidelines," arterial and venous cord blood gas analysis is recommended routinely for all births, as they may help in providing appropriate care to the newborn at birth and in planning subsequent management (Executive Committee of the Society of Obstetriciansand Gynecologists of Canada, 2000). There was also a significant relation between umbilical cord pH and low APGAR score with the incidence of selective neonatal outcomes like (NICU) admission and need for advanced resuscitation (Ahmadpour-Kacho *et al*., 2010). Lactate and pH values provide the best parameters to distinguish between Asphyxiated and normal newborns, with lactate having the most discriminating power (Woods and Glantz, 1994; Borruto *et al*., 2006). Many studies have found that babies born through moderate and thick meconium have a significantly greater risk of abnormal fetal heart rate tracings, low APGAR scores of less than 7, a cord blood pH of less than 7.2, necessity for oxygen support and NICU admissions (Woods and Glantz, 1994). Our study was aimed at finding whether there is a relationship between fetal academia as measured by umbilical artery pH in cases of meconium stained liquor and perinatal outcome. MSAF is associated with a higher rate of adverse neonatal outcome even in cases of low risk pregnancies at term.

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Aims and Objectives

To assess relationship between umbilical artery blood pH at birth and neonatal status in meconium stained liquor.

MATERIALS AND METHODS

This observational clinical study was conducted in the Department of Obstetrics and Gynecology and Neonatology, Jubilee Mission Medical College and Research Institute in a time period of December 2014 to May 2015. During this period 62 term pregnant women who were admitted in labour room with meconium stained amniotic fluid following amniotomy or spontaneous rupture of membranes were selected using inclusion and exclusion criteria. A detailed

history was obtained from these patients. Complete clinical examination was done. All the patients when they delivered (either vaginally or by cesarean section), the umbilical cords were double clamped, and an arterial blood sample was collected in a pre-heparinized syringe and the pH value was measured at 37^{o} C by blood gas analyzer. The gas analysis was done within 30 minutes of sampling. APGAR score was assessed by a trained paediatrician. If resuscitation was required, all resuscitated babies were transferred to NICU or newborn services for post resuscitation care. The neonatal outcome in the first week of life was studied.

The variables analyzed were

1. Grades of meconium
2. Condition of the baby at birth
3. Meconium grade and umbilical artery pH at birth
4. Umbilical Artery pH and NICU admission
5. Meconium grade and Apgar score at 5 minutes
6. Meconium grade and ventillatory support
7. Neonatal condition at one week

RESULTS

Among the 62 patient studied, 35.5% patients had grade 1 MSAF, 40.3% patients had grade 2 MSAF and 24.2% patients had grade 3 MSAF.

Table 1. Distribution based on the grade of meconium

MEC Grade	Frequency	Percent
1.0	22	35.5
2.0	25	40.3
3.0	15	24.2
Total	62	100.0

Table 2. Distribution based on condition at birth of the baby

Vigorous	Frequency	Percent
Non	19	30.6
Vigorous	43	69.4
Total	62	100.0

Table 3. Distribution based on Meconium grade and Umbilical artery blood pH at birth

Meconium grade * Umbilical artery pH group					
			Umbilical artery pH group		Total
			<7.20	>7.20	
Meconium grade	1	Number	2	20	22
		% within Meconium grade	9.1%	90.9%	100.0%
	2	Number	8	17	25
		% within Meconium grade	32.0%	68.0%	100.0%
	3	Number	9	6	15
		% within Meconium grade	60.0%	40.0%	100.0%
Total		Number	19	43	62
		% within Meconium grade	30.6%	69.4%	100.0%

p =0.004

Out of the 62 patients studied, in Grade 1 MSL group, 90.9% had pH >7.2, in Grade 2 MSL group 68% had pH >7.2 and 40% in Grade 3 MSL had pH >7.2

Among the 62 babies studied, 75% of babies with pH less than 7.2 were admitted in the NICU, while only 25% of babies with a pH of more than 7.2 required NICU admission.

Table 4. Distribution based on umbilical artery pH and NICU admission

UMBA pH	NICU ADM		Total
	NO	YES	
<7.19	4(9.52%)	15(75%)	19
>=7.2	38(90.47%)	5(25%)	43
Total	42(67.74%)	20(32.25%)	62

Pearson Chi-Square 27.328 ; p = 0.0001

Table 5. Distribution based on Meconium grade and APGAR score at 5 min

Meconium grade	APGAR5mint2		Total
	<7	>=7	
1	2(10.5%)	20(46.5%)	22
2	6(31.57%)	19(44.18%)	25
3	11(57.89%)	4(9.32%)	15
Total	19(30.64%)	43(69.35%)	62

Pearson Chi-Square18.189; p = 0.0001; Pearson's R =-0.510
Out of the 62 patients studied, 57.89% of babies born through grade 3 meconium had an APGAR of less than 7, 31.57% of babies born through grade 2 meconium had APGAR of less than 7 while only 2 babies born through grade 1 meconium had APGAR less than7. This is statistically significant as the p value =0.0001

Table 6. Distribution based on meconium grade and NICU admission

MEC Grade	NICU ADM		Total
	NO	YES	
1.0	21(50%)	1(5%)	22
2.0	16(38%)	9(45%)	25
3.0	5(11.9%)	10(50%)	15
Total	42	20	62

Pearson Chi-Square16.019; p = 0.0001

Out of the 62 patients studied, only 5% of babies born through grade 1 MSL required NICU admission while 50% of babies born through grade 3 MSL required NICU admission, 45% of babies with grade 2 MSL required NICU admission and this is statistically significant.

Table 7. Distribution based on meconium grade and ventillatory support

MEC Grade	VENT SUP			Total
	CPAP	ET	NIL	
1.0	1(8.33%)	0(0%)	21	22
2.0	7(58.3%)	2(25%)	16	25
3.0	4(33.33%)	6(75%)	5	15
Total	12	8	42	62

Out of the 62 cases studied, 75% of babies with grade 3 MSL required endotracheal intubation and 25% required CPAP. In grade 2 MSL, 58.3% required CPAP while 25% babies required ET. This is statistically significant as the p value is 0.0001.

Table 8. Distribution based on neonatal condition after 1 week

I WEEK	Frequency	Percent
DEAD	3	4.8
ROOMED IN	42	67.7
NICU	7	11.3
DISCHARGE	10	16.1
Total	62	100.0

DISCUSSION

The finding of meconium stained amniotic fluid during labour often causes anxiety and apprehension for the obstetrician as it is mostly considered an indicator of fetal distress. Traditionally it has been viewed that meconium is a sign of impending or ongoing fetal compromise; however some believe that it is not associated with fetal hypoxia, acidosis or fetal distress. Avoiding fetal distress is the golden aim of our obstetric practice but at the same time we should try to reduce the caesarean section rate also. The present study was carried out at Jubilee Mission Medical College Hospital, Thrissur from 2015-2016 to assess the significance of umbilical artery pH in meconium stained amniotic fluid and the associated perinatal outcome in 62 patients who were included in the study. Most studies show a link between meconium, low Apgar scores and decreased arterial cord pH values; however some show no correlation. In our study it was observed that 67.7% of patients had undergone cesarean section for meconium stained liquor while only 32.3% had a vaginal delivery. Saunders *et al* in their study reported that caesarean section was performed twice as frequently in patients with meconium stained liquor (Saunders, 1989). Such high caesarean rates may be partly due to the obstetricians concern for the fetus and their dilemma in managing such pregnancies. In a study by Nirmala *et al* among 100 meconium stained amniotic fluid cases studied, 39% had Grade 1 MSL, 43% had Grade 2 MSL and 18% had Grade 3 MSL[7]. In our study among the 62 patients studied 35% had Grade 1 MSL, 40.3% had Grade 2 MSL and 24.2% had Grade 3 MSL (Table 1). Umbilical venous lactate strongly predicts arterial lactic acidemia and is comparable with arterial lactate for predicting neonatal morbidity at term. It could be used as a measure of neonatal morbidity when arterial blood is not available (Woods and Glantz, 1994).

The American College of Obstetricians and Gynecologists recommends performing umbilical blood sampling for acid-base analysis in selected deliveries. However, in our opinion routine umbilical blood sampling at all deliveries has merit (Thorp *et al*., 1996). In the present study it was observed that 90.9% of babies in Grade 1 MSL group had a pH of >7.2, 68% of babies in grade 2 MSL group had pH >7.2 and 40% of babies with Grade 3 MSL had normal pH at birth (Table 3). In a study by Kumar N *et al*, it was found that the presence of meconium in the amniotic fluid had a highly significant relation with neonatal acidaemia; the risk of acidemia was 5.8 times higher in neonates with meconium-stained amniotic fluid than those with clear fluid (Kumar *et al*., 2016). In a study conducted by Modarressnejad, where 69 cases of meconium stained liquor was studied, it was revealed that, the concentration of meconium had a direct relation with acidaemia and the risk of acidaemia in those with thick meconium was 12.5 times higher (Modarressnejad, 2005). But on the contrary another study by Perveen *et al* showed that the grading of meconium did not show positive correlation with pH levels (Perveen *et al*., 2015). In a study by Kumari *et al*, it was found that the APGAR score at 5 minutes was less than 7 in 8.7% of babies in grade 1 MSL, 12.8% IN grade 2 MSL and 46.2% in grade 3 MSL (Kumari *et al*., 2012). In our study the APGAR score at 5 min was less than 7 in 10.5% of babies in grade 1 MSL, 37.57% in grade 2 MSL and 57.8% in grade 3 MSL. As meconium was considered a marker for fetal distress, there was significant effect on the APGAR score of the neonates. Kumar *et al*. studied the relationship between umbilical cord pH in fetal distress and found that umbilical cord pH is the best indicator of fetal hypoxemia during labor. 6 babies out of 10 with ph < 7.2 had to be admitted in NICU due to birth asphyxia. In our study 75% of babies with ph <7.2 were admitted in NICU. In the present study it was observed that 50% and 45% of babies with Grade 3 and Grade 2 MSL respectively were admitted in NICU while only 5% or 1 baby with Grade 1 MSL had to be admitted in NICU (Table 6). This shows that the thickness of meconium had a direct bearing on the neonatal outcome. In a similar study by Gupta *et al*, they had observed that the incidence of birth asphyxia was significantly higher in thick meconium compared to thin meconium (Vineeta Gupta *et al*., 1996). In our study 50% of babies in Grade 3 MSL required ventillatory support as CPAP or endotracheal intubation while 45% in grade 2 MSL required ventillatory support (Table 7). In the study by Priyadarsini V *et al*, out of the 35 babies that required NICU admission, 17(48.57%) of babies needed ventillatory support and among them, 14(40%) developed meconium aspiration syndrome and 5(14.28%) had severe birth asphyxia. The perinatal outcome was poor in our study as noted by the 32.3% of babies being admitted in NICU, and after 1 week 11.3% of babies were still in NICU (Table 8). There were 3 (4.8%) neonatal death due to MAS. This finding was similar to a study done by Sharma *et al*, where they found the mortality with meconium stained liquor was 6 %. Umbilical cord blood gas and pH values should always be obtained in the high-risk delivery and whenever newborn depression occurs (Nirmala Dhuhan *et al*., 2010). Doctors and institutions with the logistical capabilities in place should consider the cost efficacy of routine cord blood gas analysis because it is the gold standard assessment of uteroplacental function and fetal oxygenation/acid-base status at birth (Thorp and RusThing, 1999).

Conclusion

Meconium stained amniotic fluid is really worrisome from both the obstetrician's and paediatrician's point of view. It increases the caesarean section rate, causes birth asphyxia and increases neonatal intensive care admission. In our study we have observed that increased grade of meconium is associated with fetal acidosis and neonatal morbidity whereas thin meconium is shown to have a low risk of perinatal complications. 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. All meconium stained liquor babies do not need NICU admission but it is difficult to identify cases that require admission beforehand. The cord blood pH is a sensitive parameter to diagnose birth asphyxia and can be used in high risk cases as this may help to provide appropriate care to the newborn thus preventing neonatal mortality as well as morbidity. So based on our findings there is certainly a case for measuring umbilical cord blood pH in babies who were born through meconium stained liquor. More studies with a larger number of patients will clarify the picture further.

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