British Journal of Medicine & Medical Research
4(3): 914-921, 2014

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Meconium Staining of Amniotic Fluid: A Clinical Study

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Authors' contributions

This work was carried out in collaboration between all authors. Author BMH designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Authors AMM and ADA managed the analyses of the study. Author BMH managed the literature searches. All authors read and approved the final manuscript.

Case Study

Received 17th May 2013
Accepted 19th September 2013
Published 23rd October 2013

ABSTRACT

Aims: To identify the frequency of meconium aspiration syndrome among the total births who suffered from meconium staining of amniotic fluid, to find out risk factors during pregnancy, therapies and various complications associated with this condition and their effects on perinatal outcome.
Study Design: Retrospective study.
Place and Duration of Study: AL-Yarmouk Teaching Hospital, between 1st of December 2009 to 31st of May 2010.
Methodology: Total number of live birth deliveries was 5965, live births with meconium staining of amniotic fluid were 286 and meconium aspiration syndrome cases were 13. Collection of information included gestational age, fetal presentation, mode of delivery, birth weight, sex, Apgar score, type of resuscitation, treatment, associated complications and outcome. Inclusion criteria for meconium staining of amniotic fluid cases were; gestational age of ≥30 wk, presence of meconium stained skin, umbilical cord or meconium in the trachea at birth.
Results: Total number of live birth deliveries matching criteria of inclusion in the study was 5965. Of these, 286 (4.8%) cases had meconium stained amniotic fluid which included 13 (4.5% of MASF cases, 0.21% or total live births) cases of meconium aspiration syndrome. Babies who were term or normal for gestational age were more prone to meconium aspiration syndrome and meconium stained amniotic fluid (*P* = .0008

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and .016, respectively). Emergency cesarean section was significantly associated with a decreased rate of meconium stained amniotic fluid cases (*P* .0001). Thick meconium was more risky than thin (*P* = .0009).
Three neonates died due to meconium aspiration syndrome complicated by respiratory failure and pneumothorax. Mortality was 23.1% of total meconium aspiration syndrome cases and 1.04% of total meconium stain amniotic fluid cases.
Conclusion: Babies at highest risk of meconium aspiration syndrome and meconium stained amniotic fluid were those who had completed their term and who had an appropriate birth weight for their gestational age. Moreover, Thick meconium is associated with low Apgar scores and higher morbidity than thin meconium. Finally, abnormal presentation is an important risk factor for MAS, whereas emergency cesarean section is significantly associated with a decreased rate of meconium stained amniotic fluid cases.

Keywords: Amniotic fluid; meconium aspiration; fetal distress; gestational age.

1. INTRODUCTION

Meconium stained amniotic fluid (MSAF) is primarily a condition of term and post term babies [1,2]. It occurs in 10%-15% of live births [3,4] and is rarely seen prior to 37 wk of gestation. It occurs in more than 30% of pregnancies passed 42 wk of gestation [3]. In utero, meconium passage results from vagal stimulation from head or cord compression resulting in fetal hypoxic stress, and causing peristalsis and relaxation of rectal sphincter leading to meconium passage [1,5,6,7]. Stressed preterm infants during labor seldom pass meconium in utero, because the motility of intestine is decreased and anal sphincter does not usually relax [1,2,6,8]. Severe fetal asphyxia and acidosis may cause meconium aspiration prenatally, because of gasping [6]. But more often meconium is aspirated into lung immediately after delivery [5,6,7].

Five to thirty three percent of MSAF develop respiratory symptoms and radiographic changes of meconium aspiration syndrome (MAS) [3]. There is no actual sex and birth weight predilection in MSAF cases, but they have a significantly high admission rate to neonatal intensive care units [9]. MSAF in preterm labor strongly suggest listeriosis infection [1].

2. METHODOLOGY

The study was conducted to investigate to following:

1. Find out the frequency of MSAF among the live births and incidence of MAS among all the identified MSAF during the period of the study.
2. Identify the risk factors in pregnancies leading to MSAF and to study the types of therapies and various complications associated with MSAF.

The data of this study was collected retrospectively from the obstetrics and neonatal care unit's archives for total deliveries in the time period.

Inclusion criteria of MSAF cases were; gestational age (GA) of ≥30 wk, presence of meconium or meconium stained skin, umbilical cord or presence of meconium in the trachea at birth.

Inclusion criteria of MAS cases were; 1. Presence of meconium stained skin, umbilical cord, or meconium in the trachea at birth, followed subsequently by signs and symptoms of MAS (i.e. tachypnea, dyspnea, retraction, grunting or cyanosis). 2. Chest X ray (CXR) showing characteristic appearance (hyper-expanded chest, flattening of diaphragm, parenchymal lung infiltration, atelectasis, coarse opacities) [10].

Data about examination was collected; assessment of gestational age, fetal presentation(cephalic, breech), mode of delivery(cesarean section C/S, Vaginal delivery with and without instrumental delivery), birth weight, sex, Apgar score, type of meconium (thin meconium: very light green staining of amniotic fluid, thick meconium: thick greenish meconium with particulate matter in amniotic fluid) [10], type of cleaning, drying, stimulation (wiping of face, oropharyngeal suction and endotracheal intubation for suctioning), associated complications and outcome. Fetal heart monitoring was done in these cases frequently before delivery to detect sign of early hypoxia.

We also examined the maternal risk factors including maternal disease (pregnancy induced hypertension and diabetes mellitus), prolonged difficult labor (active labor that continued longer than 20 hours, and labor terminated when a primi-para has been fully dilated for two hours and a multi-para for one hour)(10), maternal age and parity and antenatal care (ANC). Furthermore, the types of treatment including antibiotics use and complications were recorded and studied.

From a management point of view, Cesarean sections were performed soon after the appearance of MSAF, neonatal resuscitation methodology followed the neonatal flow algorithm (part 13 of the neonatal resuscitation guidelines) in dealing with vigorous and non-vigorous babies [11], and all neonates had plain chest radiographs as part of their investigation.

Statistical analysis was carried out with Microsoft Excel (Microsoft, California, USA) using the Pearson Chi-squared test at a 95% level of significance.

3. RESULTS AND DISCUSSION

The total number of live births matching the inclusion criteria in the study was 5965. Of these, 286 (4.8%) cases had meconium stained amniotic fluid (MSAF) which included 13 (4.5% of MASF cases, 0.21% or total live births) cases of meconium aspiration syndrome. The proportion of MAS among MSAF of this study is comparable to proportions reported by Steven et al. [12] and Van Ierland et al. [13], but less than the proportion (12.9%) reported by Patil et al. [14], these differences could be attributed to variations in antenatal care levels between countries and to sample size [15].

The mean birth weight *of* MSAF patients was 3.344 kg (± 0.48, range: 2.605-3.440), with only 5 (1.74%) low birth weight newborns (< 2.500Kg) recorded.

Similar to the findings of Van Ierland et al. [13] and in contrast to the results of Coltart et al. [16] we could not find a gender predilection, neither in the MSAF nor in the MAS group (P =.854).

Out of the total number of deliveries with MSAF (286), there were 260 (90.9%) mature babies, 16 (5.6%) post mature and premature (3.5%), indicating that MSAF is significantly associated with mature newborns (p = 0.008) as seen in Table 1, concluding that it is indeed a disease of maturity newborns. These findings are in agreement with Jane, Halliday and Van Ierland [3,4,12], who found that 88% of MSAF cases occurred in mature babies, 8% in post mature and 4% in premature. Gestational age range in preterms was 32-36 weeks and average age was 34 weeks ± 1.83.

Table 1. The sex distribution, gestational age, birth weight in meconium stained amniotic fluid and meconium aspiration syndrome

Type of patient	Sex		Birth weight			Gestational Age		
	Male	Female	Appropriate for gestational age	Large for gestational age	Small for gestational age	Preterm (<37wk)	Term (37-42wk)	Post term (>42wk)
MSAF	169	117	245	10	31	10	260	16
MAS	8	5	8	2	3	1	10	2
P value	0.854		0.016*			0.0008*		

**Significant difference between proportions using Pearson Chi-squared test at 0.05 level of significance.*

Table 2 shows the mode of delivery in patients with meconium stained amniotic fluid in relation to the meconium aspiration syndrome group. Low forceps, *but not* vacuum, was used in instrumental deliveries, while episiotomy was done in primipara mothers.

Cesarean sections are significantly associated with a lower rate of MSAF cases (199) than total vaginal deliveries (87), *P= .00001*. There was no significant difference to be seen on the rate of MAS cases between these two methods of delivery (Table 2). Similar findings were reported by Miller and Wiswell [17,18], where MAS developed in only 3% of total MSAF cases of patients with Cesarean sections.

Table 2. The mode of delivery in patients with meconium stained amniotic fluid in relation to meconium aspiration syndrome group

Mode of delivery	No.	MSAF	MAS
Cesarean section	2459	87(3.53%)	3(0.12%)
Vaginal delivery ± Instrumental delivery	3207	199(6.2%)	10(0.31%)
P value	-	0.0001*	0.556

**Significant difference between proportions using Pearson Chi-squared test at 0.05 level of significance.*

Table 3 shows the mortality rates and Apgar scores (at five minutes) in MSAF and MAS patients who have experienced the two different types of meconium, thick or thin. Passage of thin meconium occurred in 156 (55.9%) of MSAF patients, and was not significantly associated with an increased incidence of morbidity of MSAF and MAS, *whereas* thick meconium was recorded in 130 (48.6%) of MSAF, with MAS *being* a significant complication with an incidence of 6.9% (*P= .0009*). These results are consistent with Hobel[5], Van Ierland [13], and Yong et al. [19].

Table 3. The type of meconium in patients with meconium stained amniotic fluid and meconium aspiration syndrome in relation to Apgar score and mortality

Apgar	Thin meconium (n=156)		Mortality	Thick meconium (n=130)		Mortality
5 min	MSAF	MAS		MSAF	MAS	
≤3	35	2	1	29	6	2
>3	121	2	0	101	3	0
Total	156	4	1	130	9	2
P value	*0.979*	*0.181*	-	-	*0.0009**	-

**Significant difference between proportions using Pearson Chi-squared test at 0.05 level of significance.*

Unfortunately the aminoinfusion (infusion of normal saline into amniotic cavity to dilute amniotic fluid) was not used in this hospital, which may be of benefit [13,19,20].

Chronic in-utero insult may be responsible for most cases of severe MAS. Maternal diseases, parity, irregular or poor antenatal care may have an important influence, as 203 (70.9%) of MSAF cases lacked correct antenatal care in form of scheduled regular visits to antenatal health centers while 83 (29%) had regular follow-up.

Of possible risk factors associated with pregnancy and delivery, only abnormal presentation was an important risk factor for MAS, (*P=.028)*, in accordance with the findings of Dargaville [15], Miller [17] and Urbaniak [21]. More details can be found in Table 4.

Table 4. The effect of risk factors on pregnancies in meconium stained amniotic fluid and meconium aspiration syndrome

Risk factors		MSAF		MAS		*P* value
		No.	%	No.	%	
Maternal disease	Diabetes mellitus	15	5.2%	2	15%	
	Hypertension	35	12.2%	4	30%	
	Urinary tract infection	110	38.5%	2	15%	
Parity	Primipara	94	33%	5	38%	*0.801*
	Multipara	192	67%	8	62%	
Antenatal care	Regular	83	29%	4	31%	*0.896*
	Irregular	203	71%	9	69%	
Prolonged labor	Yes	149	52%	8	62%	*0.868*
	No	137	48%	5	38%	
Presentation	Cephalic	246	86%	8	62%	*0.028**
	Breech	27	9%	3	23%	
	Others	13	5%	2	15%	

**Significant difference between proportions using Pearson Chi-squared test at 0.05 level of significance.*

There were no significant differences (*P =.240*) between types of stimulation/ cleaning, wiping of face and oropharyngeal suction before delivery of shoulders and resuscitation via endotracheal intubation and suctioning, as of 286 babies with MSAF five (3.8%) developed MAS after wiping of face, while six babies (4.3%) developed MAS after oropharyngeal suction. Tracheal intubation and suction in the resuscitation of depressed babies, *which has been described to be of value* in reducing morbidity was used in 5.3% of MSAF cases only, and 15.4% of them developed MAS. Our study could not confirm statistical differences

between these methods as they had been described elsewhere [21,23,24,25]. More details are found in Table 5.

Table 5. The methods of resuscitation and effectiveness to prevent meconium stained amniotic fluid and meconium aspiration syndrome

Type of stimulation and resuscitation	MSAF (n=286)	MAS (n=13)
Wiping face	131(45.8%)	5 (38.4%)
Oropharyngeal suction	140 (48.9%)	6 (46.2%)
Endotracheal intubation and suction	15 (5.3%)	2 (15.4%)
P value	*0.240*	

**Significant difference between proportions using Pearson Chi-squared test at 0.05 level of significance.*

Mortality was 3 (23.1%) neonates out of total 13 MAS cases, while it accounts (1%) of total MSAF. Of MAS associated complications, three neonates (23%) with MAS developed pneumothorax, managed properly by surgical intervention, but unfortunately one of them died. Three neonates (23%) had developed acute respiratory failure associated with repeated hypoxic fits (15.3%) and two of them died. The most common cause leading to death was pneumothorax, seizures and respiratory failure. Mortality was 3 (23%) neonates out of total 13 MAS cases, while it accounts (1%) of total MSAF, as seen in Table 6. Proportions of this study are within the range of 1 – 8.3% reported by some researchers [5,14,16].

Table 6. The complications and outcome in meconium aspiration syndrome patients

Complications	MAS (13)	
	No.	%
Pneumothorax	3	23%
Respiratory failure	3	23%
Seizure	2	15.3%
Outcome Death	3	23%
Discharge well	10	76.9%

4. CONCLUSION

Our study shows that MSAF is a neonatal problem causing morbidity and mortality among neonates, and those babies at highest risk of meconium aspiration syndrome and meconium stained amniotic fluid were those who had completed their term and who had an appropriate birth weight for their gestational age.

Moreover, the current study concludes that thick meconium is associated with low Apgar scores and higher morbidity than thin meconium.

Finally, abnormal presentation is an important risk factor for MAS, whereas emergency cesarean section is significantly associated with a decreased rate of meconium stained amniotic fluid cases.

CONSENT

This retrospective study didn't need written consent.

ETHICAL APPROVAL

This is to verify that the ethical Committee approves and agrees that this study, titled (Meconium staining of amniotic fluid and meconium aspiration syndrome: A clinical study) is a clinical retrospective study, which by no means is against the privacy or human rights, and is for the best of public interest.

ACKNOWLEDGEMENTS

There was no involvement of sponsors in this study.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Curtis PD, Matthews TG, Clarke TA. Neonatal seizures: McIntosh N, Helm P. Smyth R.: Meconium Aspiration Syndrome, The Newborn In: Forfar and Arneils textbook of paediatrics. 6th. ed. 2004:185-86
2. Ramin KD, Leveno KJ, Kelly MA, et al. Amniotic fluid meconium. In: Robert MK, Richard EB, Hal BJ, editors. Nelson Textbook of Pediatrics.16th ed. 2000:505-506
3. Jane S. Lee, Ann R. Stark: Meconium Aspiration. Manual of Neonatal Care. 5th ed. 2004:402-06.
4. Halliday HL. Endotracheal intubation at birth for preventing morbidity and mortality in vigorous, meconium-stained infants born at term. In: Robert MK. Kliegman MD, Richard EB: Meconium Aspiration. Nelson Textbook of Pediatrics 18th ed. 2008;101(7):742-743.
5. Hobel CJ, Bochner C. Meconium staining of Amniotic Fluid. In: Assessment and Care of the Fetus. 1990:801-09.
6. Davis PJ, Shekerdemian LS. MAS and ECMO; Behrman RE, kligman RM. Kligman RM: Fetal and neonatal Medicine. In: Nelson Essential of Pediatric. 3rd ed. 1998:197-98.
7. Haurani F, Kyle R, Hutchison JL, Forcier RJ, Moon JH. Low Birth Weight .In: Practical Pediatrics Problem. 6th ed. 1968:36.
8. Osterea EM, Naqvi M. The Influence of Gestational Age on the ability of the Fetus to Pass Meconium in Utero. Acta Obstet. Gynecol. Scand. 1982;61:275-7
9. Ahlam A, Haifaa DJ. Maternal and neonatal complications in relation to meconium-stained amniotic fluid. Bas J Surg; September, 14, 2008.
10. Narang A. Definition of major illnesses as applicable at different levels of the health care delivery system. In: Neonatal Nomenclature and Data Collection. Eds. Singh M, Paul VK, Bhakoo ON. Delhi, Vani Press. 1989;27-35.
11. American Heart Association. 2005 American Heart Association (AHA) guidelines for cardiopulmonary resuscitation (CPR) and emergency cardiovascular care (ECC) of pediatric and neonatal patients: pediatric basic life support. Pediatrics. 2006;117(5):e989-1004.

12. Steven L. Gelfand MD, Jonathan M. Fanaroff JD, Michele CW. Meconium stained fluid; approach to the mother and the baby; Pediatr Clin N Am 51. 2004;655– 667
13. Van Ierland Y, de Boer M and de Beaufort AJ. Meconium-stained amniotic fluid: discharge vigorous newborns: Arch Dis Child Fetal Neonatal 6th ed. 2010;95:F69-F71
14. Patil KP, Swamy MK, Samatha K. A one year cross sectional study of management practices of meconium stained amniotic fluid and perinatal outcome: J Obstet Gynecol India. 2006;56(2):128-130.
15. Dargaville PA, Copnell B. Australian and New Zealand Neonatal Network. The epidemiology of meconium aspiration syndrome: incidence, risk factors, therapies, and outcome. Pediatrics. 2006;117(5):1712-21.
16. Coltart TM, Byrne DL, Bate SA. Meconium Aspiration Syndrome, A 6 Year Retrospective Study. British J. Obstet. Gynecol. 1989;96:411-14
17. Miller FC, Sacks DA, Paul RH. Significance of Meconium during Labor. Am. J. Obstet. Gynecol. 1975;122(5):573-79
18. Wiswell TE, Gannon CM, Jacob J, Goldsmith L, Szyld E, Weiss K, et al. Delivery room management of the apparently vigorous meconium-stained neonate: results of the multicenter, international collaborative trial. Pediatrics. 2000;105(1 Pt 1):1-7.
19. Yong-YP, HO-LY: A 3 year Review of Meconium Aspiration Syndrome. Singapore J. 1997;38(5):205-8.
20. Whitfield JM, Charsha DS, Chiruvolu A. Prevention of meconium aspiration syndrome: an update and the Baylor experience. Proc (Bayl Univ Med Cent). 2009;22(2):128-31.
21. Urbaniak KJ, McCowan LM, Townend KM. Risk factors for meconium-aspiration syndrome. Aust N Z J Obstet Gynaecol. 1996;36(4):401-6.
22. Vain NE, Szyld EG, Prudent LM, Wiswell TE, Aguilar AM, Vivas NI. Oropharyngeal and nasopharyngeal suctioning of meconium-stained neonates before delivery of their shoulders: multicentre, randomised controlled trial. Lancet. 2004;364(9434):597-602.
23. Kattwinkel J, editor. Textbook of neonatal resuscitation. American Academy of Pediatrics. Chicago. 4th ed.; 2000;5–15.
24. Vain NE, Szyld EG, Prudent LM, Aguilar AM. What (not) to do at and after delivery? Prevention and management of meconium aspiration syndrome. Early Hum Dev. 2009;85(10):621-6.
25. Ting P, Brady JP. Tracheal Suction in Meconium Aspiration Am. J. Obstet. Gynecol. 1975;122(6):767-70.

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http://www.sciencedomain.org/review-history.php?iid=306&id=12&aid=2359