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Role of intrapartum amnioinfusion in meconium-stained amniotic fluid: A case-control study

Rajashree Babasaheb Bhosale
Department of Obstetrics and Gynecology, Krishna Institute of Medical Sciences, Karad, Maharashtra, India – 415110.

Sanjay Kumar Patil
Professor, Department of Obstetrics and Gynecology, Krishna Institute of Medical Sciences, Karad, Maharashtra, India – 415110
Corresponding Author: Dr. Sanjay Kumar Patil

Dr. Yamini Patil
Associate Professor, Department of Obstetrics and Gynecology, Krishna Institute of Medical Sciences, Karad, Maharashtra, India – 415110.

***Abstract*---**Background: Intrapartum amnioinfusion in meconium-stained amniotic fluid has been known to dilute the meconium and prevent meconium aspiration syndrome (MAS). However, the literature available on intrapartum amnioinfusion is varying. Objective: To assess the neonatal outcomes following intrapartum transcervical amnioinfusion in full-term pregnant women. Methods: This case-control study included pregnant women in active labor, divided into case group (n=63) receiving amnioinfusion and control group (n=63) without amnioinfusion. In the case group, 500 mL of warm, normal saline was infused into the uterine cavity. Both groups were compared for liquor quality, mode of delivery, and neonatal outcomes like APGAR score, resuscitation, meconium presence, MAS, neonatal intensive care unit (NICU) admission, and length of NICU stay. Chi-square test was used to analyze the difference between cases and controls. Results: Mode of delivery was spontaneous vaginal delivery in most cases (71%), with only 19% undergoing cesarean section. APGAR score at 1 min was >7 in cases compared to controls, which was significant (12.69% vs 0%, P=0.005). Resuscitation was required less in cases than controls (9.52% vs 50.79%, P<0.001). Presence of meconium below the vocal cord was more in controls (34.92% vs 4.76%, P=0.003). MAS was observed more in controls (26.98% vs 4.76%, P<0.001). NICU admissions were required more in control group and received more antibiotics and IV fluids (P<0.001). Length of NICU stay was longer in control group (P=0.004). Conclusion:

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Intrapartum amnioinfusion during labor in meconium-stained amniotic fluid is an effective method for preventing MAS and improving the neonatal outcomes.

***Keywords*---**Meconium Aspiration Syndrome, Saline Solution, Neonatal Intensive Care Unit, Obstetric Labor.

Introduction

Meconium aspiration syndrome (MAS) is a primary cause of respiratory morbidity in term and near-term neonates.[1] It has been reported that 5-12% of infants born with meconium-stained amniotic fluid (MSAF) develop MAS.[2] MSAF has been reported to increase the rate of operative interference in the form of cesarean section or instrumental delivery and increased need for resuscitation and MAS.[3]

The risk of MAS has not been shown to reduce with prophylactic intrapartum oropharyngeal and nasopharyngeal suctioning; hence, intrapartum amnioinfusion was considered.[4,2] Some studies have proposed transcervical amnioinfusion as a means for reducing the complications.[5] Amnioinfusion is a process in which normal saline is infused into the uterine cavity to replace the amniotic fluid and is used to treat decreased inter-amniotic volume, oligohydramnios, and fetal distress. Intracervical instillation of normal saline into the uterus during labor decreases the concentration of meconium in the amniotic fluid, thereby reducing the occurrence of MAS. It is also used to treat reduced intra-amniotic volume including prophylactic treatment of oligohydramnios and fetal distress during labor.[6]

A lower incidence of MAS, cesarean deliveries, and perinatal mortality after amnioinfusion were reported in a systemic review of randomized trials; however, these trials had small sample size and had no clearly defined outcomes.[7] Moreover, some authors did not validate these advantages in their studies.[8,9] Available literature concerning the advantages of amnioinfusion in MSAF are variable. Hence, a case-control study was conducted to assess the neonatal outcomes following intrapartum transcervical amnioinfusion in full-term pregnant women.

Methodology

Study design

This case-control study was carried out in the Department of Obstetrics and Gynecology of a tertiary care hospital in Maharashtra, India, from 2012 to 2014. Ethical approval was obtained from the Institutional Ethics Committee before initiating the study (Ref No. KIMSDU/IEC/02/2012). The signed informed consent form was obtained from all patients prior to the study initiation. For an effect size of 0.353 at 95% significance level and 80% power, a sample size of 63 patients in each group with a total of 126 subjects was obtained.

Selection criteria

Singleton pregnant women at term with vertex presentation, cervical dilation of 3-5 cm, engaged head, rupture of membrane, and in active stage of labor were included in the study. Exclusion criteria comprised intrauterine deaths, major fetal anomalies, malpresentations, chorioamnionitis, cardiovascular disease in mother, and previous cesarean delivery. A total of 126 pregnant women meeting the inclusion criteria were divided into case group (n=63) and control group (n=63). Women in case group received amnioinfusion and those in control group received standard care without amnioinfusion.

Data collection

Data on age, gravidity and gestational age, quality of liquor, mode of delivery and neonatal outcomes such as APGAR (appearance, pulse, grimace, activity, and respiration) score, neonatal resuscitation technique required, presence of meconium, MAS, NICU admission, treatment received in NICU, and the length of NICU stay were recorded in a predesigned structured proforma.

Procedure

Abdominal examination with ultrasonography was performed for all patients to confirm the amount of liquor, fetal lie and presentation during labor, and fetal heart rate. Per vaginal examination was done to evaluate the cervical dilatation, effacement, and station of presenting part. In the case group women, two fingers were passed between the cervix and head and a nasogastric tube no. 8 was introduced into the uterine cavity for about 20 cm above the fetus head and 500 mL of warm normal saline infusion was introduced under aseptic conditions. During the amnioinfusion, the subjects were placed in the left lateral position. The fetal heart rate was monitored by continuous electronic fetal monitoring, and antibiotic was given for prophylaxis (Cefazoline 1 g IV Inj). For cervical dilation of less than 1 cm in both groups, oxytocin was started on an hourly basis. Amnioinfusion was discontinued just before delivery. All neonates were subjected to intrapartum suction of mouth, oropharynx, and hypopharynx.

Statistical analysis

Data were entered in Microsoft Excel Spreadsheet and analyzed with the IBM® SPSS Statistics for Windows, Version 20.0 software. Continuous data were expressed as frequencies and percentages. Chi-square test was used to analyze the difference between the cases and controls. For all analyses, a *P* value of <0.05 was considered as statistically significant.

Results

Most women were aged between 21-25 years in both the case (57%) and control (44%) groups. The mean age of the women in the case and control groups was 23.60±3.26 and 24.79±3.79 years, respectively. Gravidity-wise, most women were primigravid in the case (61%) and control (71%) groups. The gestational age in the

case (78%) and control (50%) groups was mostly between 37-40 weeks, with an average of 39.79±1.79 and 39.65±1.32 weeks, respectively.
The quality of liquor after amnioinfusion in the case group was clear for most women (58%), and there was no case of thick meconium observed in the case group (Table 1).

Table 1
Dilution effect of liquor after amnioinfusion in the case group

Variables	Cases	
	Number (n=63)	Percentage (%)
Quality of liquor after dilution		
Clear	37	58
Thin meconium	26	42
Thick meconium	0	0

Chi-square test was used to analyze the APGAR scores between the case and the control groups at 1, 5, and 10 min. The APGAR scores at 1 min (12.69 vs 0%, *P*=0.005) and 5 min (96.82% vs 93.65%) in the case group were >7, which was considerably different between the two groups. At 10 min, all the neonates were doing well and scored >7 (Table 2).

Table 2
APGAR score in case and control groups

APGAR score	1 min		5 min		10 min	
	Case	Control	Case	Control	Case	Control
<3	0	2	0	0	0	0
4-7	55	61	2	4	0	0
>7	8	0	61	59	63	63
P value	0.005*		0.402*		NA	

APGAR: Appearance, pulse, grimace, activity, and respiration; NA: Not applicable; *: Chi-square test

The mode of delivery was spontaneous vaginal delivery for most of the women in case group (71%) with only 12 patients undergoing lower segment cesarean section (LSCS) (19%). The APGAR scores between the cases undergoing LSCS and the control group at 1, 5, and 10 min were analyzed and compared. The difference in the APGAR scores between cases undergoing LSCS and control group was significant at both 1 min (*P*<0.001) and 5 min (*P*<0.001) (Table 3).

Table 3
Comparison of APGAR scores between cases undergoing LSCS and control

APGAR score	1 min		5 min		10 min	
	Cases undergoing LSCS	Control	Cases undergoing LSCS	Control	Cases undergoing LSCS	Control
<3	0	2	0	0	0	0

4-7	12	61	0	4	0	0
>7	0	0	12	59	12	63
P value	<0.001*		<0.001*		NA	

APGAR: Appearance, pulse, grimace, activity, and respiration; LSCS: Lower segment cesarean section; NA: Not applicable; *: Chi-square test

Resuscitation was required less in the case group than in the control group, and this difference was highly significant (9.52% vs 50.79%, *P*<0.001). The presence of meconium below the vocal cord was more in the control group (34.92% vs 4.76%) and the difference was significant (*P*=0.003). A significant difference in MAS was noted between the control and case groups (26.98 vs 4.76%, *P*<0.001). NICU admissions were required more for neonates in the control group and received more antibiotics and IV fluids (*P*<0.001). The length of NICU stay for control group was longer than case group (*P*=0.004). There were no perinatal deaths observed in our study (Table 4).

Table 4
Neonatal outcomes

Variables	Cases (n=63)	Controls (n=63)	*P* value
Resuscitation techniques required			
Bag and mask	3	10	<0.001*
Endotracheal suction	2	15	
Endotracheal suction + O_2	1	5	
Endotracheal suction + intubation + O_2	0	2	
Presence of meconium			
Below vocal cord	3	22	0.003*
Staining of body	10	9	
Meconium aspiration syndrome			
Present	3	17	<0.001*
Absent	60	46	
NICU admission			
Yes	6	32	<0.001*
Mother's side	57	31	
Treatment received in NICU			
Antibiotic	3	10	<0.001*
IV fluids	1	12	
Anticonvulsant therapy	0	2	
Antibiotic + IV fluids	2	8	
Length of NICU stay (Days)			
<5	5	11	0.004*
6-12	1	9	
>12	0	2	

O_2: Oxygen; NICU: Neonatal intensive care unit; IV: Intravenous; *: Chi-square test

Discussion

MSAF is a condition frequently encountered during labor. Thick meconium is associated with the occurrence of MAS and increased risk of perinatal morbidity and mortality.[10] In this study, we evaluated the efficacy of amnioinfusion in reducing the risk of MAS in neonates.

In the case group, the presence of meconium below the vocal cords was decreased dramatically relative to the control group. Similar finding has been reported by Yellayi et al (13.33% vs 36.66%, *P* <0.05).[11] Amnioinfusion was able to reduce the meconium below the vocal cords better in cases than in control group. A significant number of neonates in this study developed MAS in the control group compared to the case group (26.98% vs 4.76%, *P*<0.001). Bhatia et al also reported similar findings (18% vs 6%).[5] Reduced occurrence of MAS in the case group may be attributed to decreased meconium level below the vocal cord, reduced fetal gasping, and successful neonatal resuscitation after delivery.

There was a significantly higher percentage of normal vaginal delivery in the case group, which is in agreement with Choudhary et al's findings (70.54% vs 31.51%, P<0.001).[12] One possible reason for the decline in the rate of cesarean section with amnioinfusion is that increased amniotic fluid volume may have reduced vagal stimulation due to cord compression, avoiding decelerations perceived as fetal distress and thereby reducing the need for cesarean section. The APGAR scores at 1 and 5 min were >7 in the case group than in the control group (12.69% vs 0%, *P*=0.005). This observation was comparable to the study by Choudhary et al. In their study, neonates who received amnioinfusion had a better APGAR score (10.27% vs 0.68%, *P*<0.001).[12] MAS has been linked to fetal distress with a low APGAR score or an irregular fetal heart rate.[13,14]

MAS necessitates the requirement of mechanical ventilation, often high-frequency ventilation, nitric oxide, surfactant administration, and extracorporeal membrane oxygenation.[14-16] In our study, resuscitation was required more in the control group than in case group, with endotracheal suction being the most commonly used resuscitation technique. Intubation was not required in the case group, with supplementary oxygen required in only one newborn. When MAS reduced and APGAR improved in the case group, fewer neonates experienced respiratory distress and did not require ventilation assistance or NICU admission. However, in the control group, nearly half of the neonates required admission in NICU. This significant difference was also observed by Rathorea et al.[17]

Based on the results of our study, we can infer that amnioinfusion reduced the need for cesarean deliveries, improved the APGAR score, decreased the need for resuscitation, decreased the presence of meconium below vocal cord and MAS and reduced the overall NICU admissions, and shortened the length of hospital stay. Hence, intrapartum amnioinfusion is a beneficial procedure in pregnant women with MSAF. Some limitations do exist in our study such as induction of labor was not included. Due to lack of resources, cord blood pH and cord blood electrolytes could not be studied.

Conclusion

Intrapartum amnioinfusion during labor in the meconium-stained amniotic fluid is an effective method for preventing MAS and overall improving the neonatal outcomes, particularly in a limited resource setting.

References

1. Dargaville PA, Copnell B, Australian and New Zealand Neonatal Network. The epidemiology of meconium aspiration syndrome: Incidence, risk factors, therapies, and outcome. Pediatrics 2006;117:1712-21.
2. Wiswell TE, Gannon CM, Jacob J, Goldsmith L, Szlyd E, Weiss K, et al. Delivery room management of the apparently vigorous meconium-stained neonate: Results of the multicenter, international collaborative trial. Pediatrics 2000;105:1-7.
3. Shaikh EM, Mehmood S, Shaikh MA. Neonatal outcome in meconium stained amniotic fluid-one year experience. J Pak Med Assoc 2010;60:711-4.
4. 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;364:597-602.
5. Bhatia P, Reena K, Sangita N. Role of intrapartum transcervical amnioinfusion in patients with meconium-stained amniotic fluid. J Obstet Gynaecol India. 2013;63:59-63.
6. Bansal N, Gupta V, Nanda A, Chaudhary P, Tandon A, Behl N. Intrapartum Amnioinfusion in Meconium-Stained Liquor: A Case–Control Study. J Obstet Gynaecol India. 2013;63:164-7.
7. Hofmeyr GJ. Amnioinfusion for meconium-stained liquor in labor. Cochrane Database Syst Rev 2002;(1):CD000014.
8. Xu H, Hofmeyr J, Roy C, Fraser WD. Intrapartum amnioinfusion for meconium-stained amniotic fluid: A systematic review of randomised controlled trials. BJOG. 2007;114:383-90.
9. Pierce J, Gaudier FL, Sanchez-Ramos L. Intrapartum amnioinfusion for meconium-stained fluid: Meta-analysis of prospective clinical trials. Obstet Gynecol 2000;95:1051-6.
10. Yoder BA, Kirsch EA, Barth WH, Gordon MC. Changing obstetric practices associated with decreasing incidence of meconium aspiration syndrome. Obstet Gynecol 2002;99:731-9.
11. Yellayi ASS, Aruna S, Devi HD. Role of Amnioinfusion in Prevention of Meconium Aspiration Syndrome. Int J Sci Stud 2017;5:272-7.
12. Choudhary D, Bano I, Ali SM. Does amnioinfusion reduce caesarean section rate in meconium-stained amniotic fluid. Arch Gynecol Obstet 2010;282:17-22.
13. Liu WF, Harrington T. Delivery room risk factors for meconium aspiration syndrome. Am J Perinatol 2002;19:367-78.
14. Goldsmith JP. Continuous positive airway pressure and conventional mechanical ventilation in the treatment of meconium aspiration syndrome. J Perinatol 2008;28:S49-55.

15. Bhutani VK. Developing a systems approach to prevent meconium aspiration syndrome: Lessons learned from multinational studies. J Perinatol 2008;28:S30-5.
16. Dargaville PA, Copnell B, Australian and New Zealand Neonatal Network. The Epidemiology of Meconium Aspiration Syndrome: Incidence, Risk Factors, Therapies, and Outcome. Pediatrics 2006;117:1712-21.
17. Rathor AM, Singh R, Ramji S, Tripathi R. Randomized trial of amnioinfusion during labor with meconium stained amniotic fluid. BJOG 2002;109:17-20.