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ORIGINAL ARTICLE

Intrapartum Amnioinfusion in Meconium-Stained Liquor: A Case–Control Study

Bansal Neeta · Gupta Vineeta · Nanda Anuja · Chaudhary Priyanka · Tandon Archna · Behl Neelima

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Abstract
Objective The aim of this study was to investigate perinatal outcome and the rate of cesarean section (CS) following intrapartum amnioinfusion in women with meconium-stained amniotic fluid (MSAF).
Method A total of 100 women at term in labor with meconium were randomized to infuse transcervical intrapartum amnioinfusion with saline (50) and routine obstetrical care (50). Perinatal outcome and obstetric outcome were recorded and analyzed in both groups by means of Chi-square test.
Result The CS rate due to fetal distress was 40.0 % in the control group and 20.0 % in the study group. The difference was statistically significant ($P < 0.01$). Respiratory distress of the neonate was significantly less common in the study group than in the control group (4.0 % vs. 12 %; $P = 0.0349$).
Conclusion Amnioinfusion in cases of meconium-stained liquor significantly improved neonatal outcome and CS rate without increasing any maternal and fetal complications.

Bansal N. (✉), Associate Prof. · Gupta V., Prof. & Head · Nanda A., Assistant Prof. · Chaudhary P., S.R. · Tandon A., S.R. · Behl N., S.R.
Department of Obstetrics and Gynaecology, SG RRIHMS & Shri Mahant Indiresh Hospital, Patel Nagar, Dehradun 248001, Uttarakhand, India
e-mail: neetanbansal@gmail.com

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Introduction

Amnioinfusion is a procedure in which normal saline is infused into the uterine cavity to replace amniotic fluid. It is used to treat problems known to be associated with decreased intra-amniotic volume, including prophylactic treatment of oligohyramnios and treatment of fetal distress during labor. Fetal heart rate (FHR) and checking the presence of meconium in the amniotic fluid are the commonly used methods to establish fetal distress, especially in the case of set-up where facilities of cardiotocography and fetal scalp blood pH estimation are not available. Aspiration of the meconium into the fetal or neonatal lung is associated with clinical disease ranging from mild respiratory distress to severe respiratory compromise, and causes significant increase in perinatal morbidity and mortality. Various methods such as intrapartum amnioinfusion (IAI) and trachesophageal suctioning at birth have been employed to decrease meconium aspiration. The instillation of normal saline into the uterus during labor reduces meconium concentration and thereby the effect of aspiration. If cervical findings are favorable, then IAI coupled with careful FHR monitoring can lead to avoidance of cesarean section (CS) in this situation. Many studies have reported a decrease in newborn respiratory complications resulting from meconium aspiration in patients who receive amnioinfusion.

Aims and Objectives

The present study was conducted in Sri Guru Ram Rai Institute of Medical & Health Sciences, Dehradun with the following objectives:

1. To study perinatal outcome following IAI in patients with meconium-stained liquor.
2. To assess the rate of cesarean deliveries following intrapartum transcervical amnioinfusion in women with meconium-stained amniotic fluid (MSAF).
3. The two groups were matched for gravidity and parity.

Method

The current study was conducted from July 2010 to June 2011 in SMI Hospital affiliated to SGRR Medical College, Dehradun. Inclusion and exclusion criteria were as follows:

Inclusion Criteria

Women in labor with thick meconium staining of the amniotic fluid; a single fetus in the cephalic presentation with a gestational age of 37 weeks or more; ruptured membranes; cervical dilatation between 3 and 8 cm; and no indication for urgent delivery (e.g., loss of FHR variability and late decelerations) were included in the study.

Exclusion Criteria

Women were excluded if there was a major fetal anomaly, chorioamnionitis, antepartum hemorrhage, hepatitis B or C, active genital herpes, polyhydramnios, indication for urgent delivery (cord prolapse, and severe fetal bradycardia), or an inability to comprehend the consent form.

A total of 100 women were randomly assigned at a ratio of 1:1 to either amnioinfusion or standard care (fetal heart was monitored by Doppler and Cardio-tocography). A sterile catheter was introduced transcervically to a depth of 30 cm, and a bolus of 600 ml of sterile saline at room temperature was infused under the force of gravity at a rate of 20 ml/min over a period of 30 min. More fluid was infused at the same rate till the returning fluid is clear or up to a maximum of 1,000 ml. The control group was not given any IAI. Women were assessed by uterine palpation at 15-min intervals for uterine hypertonic contractions. In such cases, amnioinfusion was discontinued. Continuous electronic FHR monitoring was performed in both groups. Augmentation for inadequate uterine contraction was done with use of Oxytocin if there was a delay in the progress of labor and no fetal Bradycardia recorded. Emergency CS was done when fetal Bradycardia was recorded or in case of non-progress of labor. Careful suctioning of the oropharynx and nasopharynx was performed before presentation of the shoulders and again immediately after delivery. Laryngoscopy and tracheal intubation and suctioning were reserved for infants with respiratory depression requiring positive-pressure ventilation.

The composite primary outcome measure was the occurrence of perinatal death, moderate or severe meconium aspiration syndrome, or both. In accordance with clinical criteria, the meconium aspiration syndrome was defined as respiratory distress in the first 4 h after birth and categorized as severe (requiring assisted mechanical ventilation) or moderate (requiring oxygen for at least 48 h at a concentration of 40 % or greater but without mechanical ventilation).

Secondary outcomes included perinatal death or maternal death or serious morbidity or both. Serious perinatal morbidity included moderate or severe meconium aspiration syndrome; hypotonia; assisted ventilation or intubation of more than 5 min duration; a 5-min Apgar score below 7; an umbilical-artery blood pH value below 7.05; abnormal consciousness; the need for tube feeding; convulsions; and a blood or lumbar culture positive for bacteria. Serious maternal morbidity included the presence of any of the following: uterine rupture, amniotic-fluid embolism, antepartum hemorrhage requiring urgent delivery, postpartum hemorrhage.

Requiring transfusion, hysterectomy, admission to the intensive care unit, or disseminated intravascular coagulation.

The FHR tracings were categorized as normal, as having abnormalities of insufficient severity to justify clinical intervention, or as having abnormalities requiring clinical intervention. The presence of decreased heart rate variability with late or prolonged decelerations was considered reason for intervention.

All women were analyzed according to the group to which they had been randomly assigned. We used Student's t test to compare continuous variables and the Chi-square test or Fisher's exact test for categorical variables. The effects of the intervention were expressed as relative risks with their 95 % confidence intervals. We used the SAS statistical software package (version 8.0).

Results

A total of 100 women were studied, 50 in each group. The two groups were comparable with respect to age, duration of pregnancy, pregnancy complications, and labor characteristics as seen in Table 1.

Table 2 shows the outcome of the study alongwith statistical analysis of the results. The CS rate due to fetal distress was 40.0 % in the control group and 20.0 % in the study group. The difference was statistically significant ($P < 0.01$). Apgar score <5 at 1 min was 12.0 % in the control group

Table 1 Baseline data

Characteristic	Study group ($n = 50$)	Control group ($n = 50$)
Average age (years)	24.3 (range 18–32.3)	23.0 (range 17.1–35.0)
Average gestational age (weeks)	38.7 (range 36.4–40.0)	37.9 (range 36.0–40.3)
Average birth weight (kg)	2.5 (range 2.0–2.80)	2.6 (range 2.2–2.9)
Pregnancy complications		
Post term	4	5
IUGR	3	0
Pregnancy induced hypertension	5	4
Average cervical dilatation (cm) at the time of amnioinfusion	4.9 (range 4.2–6.1)	5.1 (range 4.0–6.9)
Average time interval between amnioinfusion and delivery (h)	2.6 (range 2.3–3.6)	2.9 (range 2.3–3.6)

Table 2 Comparison of outcomes in study and control group

Outcome	Study group ($n = 50$)		Control group ($n = 50$)		χ^2	P value
	Number	Percent	Number	Percent		
Cesarean section for fetal distress	10	20	20	40	10.47	0.0012
Instrumental delivery	4	8	10	20	0.05	NS
Apgar < 5						
1 min	2	4	6	12	3.39	0.0656
5 min	2	4	2	4	1.10	0.2943
Respiratory distress	2	4	6	12	4.45	0.0349
Meconium below the vocal cords	6	12	18	36	24.15	0.00001
Meconium aspiration syndrome	3	6	5	10	2.25	0.0001
Perinatal death	0	0	0	0	0	0
Maternal pyrexia	4	8	5	10	0.23	0.6315

compared to 4.0 % in the study group ($P = 0.06$). The 5-min apgar score was also better ($P = 0.29$) in the study group.

The rate of meconium aspiration syndrome was 5.0 % in the control group and 2.5 % in the amnioinfusion group. Respiratory distress of the neonate was significantly less common in the study group than in the control group (4.0 % vs. 12 %; $P = 0.0349$). Laryngoscopic finding of meconium below the vocal cords in neonates was 36 % in the control group compared to only 6.0 % in the study group. The difference was statistically significant ($P < 0.001$) indicating thereby that meconium aspiration would have been much higher if IAI was not given. Also respiratory distress and MAS were higher in the control group. There were no perinatal deaths in the study group as well as the control group. Postpartum fever was more or less at equal rate in both groups. There was no increase in neonatal infection rate. There was no case of hypertonic uterine contractions.

Discussion

The two groups matched in all respects including the prevalence of IUGR and postdated pregnancy which are considered as confounding variables for both passage of meconium and MAS. In our study, in the amnioinfusion group, rate of CS was significantly less ($P < 0.01$) as has also been reported by Das et al. [1] and Sahu [2]. Similarly, in a study by Rathorea et al., the CS rate in amnioinfusion group was significantly lower (21 %) compared with the control group (36 %) with relative risk (RR) of 0.47. In our study, respiratory distress was significantly lower in the study group ($P = 0.03$). The incidence of MAS was 2.1 % in the study group and 9.47 % in the control group ($P = 0.06$), which are also comparable to those reported by Rathorea et al. [3]. Meconium below the vocal cords was significantly higher ($P < 0.001$) in the control group similar to the findings of Das et al. [1] and Rathorea et al. [3]. Rathorea found that amnioinfusion was associated with a significant decrease in the incidence of meconium at the vocal cords ($P = 0.001$): improvement in 1-min apgar scores ($P < 0.05$), respiratory distress ($P = 0.002$), and fewer admissions to nursery as compared with the controls. On the contrary, Fraser et al. in his study found that amnioinfusion did not reduce the risk of meconium aspiration syndrome or perinatal death. There were no perinatal deaths in the current study in both the groups, which was

different from the findings of Rathorea et al. [3], who reported 2 % perinatal deaths in their study group and 5 % in the control group. In spite of intrauterine catheter introduction and saline infusion, the incidence of puerperal pyrexia was lower in the study group. The decrease is probably due to dilutional effect on bacteria that enter the uterus. Rathorea et al. [3] and Hofmeyr [4] also found similar results.

A study by Fraser et al. [5] showed that the rates of perinatal death, moderate or severe meconium aspiration syndrome, or both did not differ according to whether amnioinfusion was or was not performed. However, as has already been discussed, many studies have proved the efficacy of amnioinfusion in preventing MAS and in decreasing the CS rate [1–4] as seen in this study also. Amnioinfusion is only one of a number of interventions aimed at reducing the risk of the meconium aspiration syndrome. Others include electronic fetal heart-rate monitoring, operative delivery in selected cases, and airway support in the newborn period. The relative benefits of amnioinfusion could depend on the pattern of use of these co-interventions. Amnioinfusion reduces high vagal stimulation because of correction of oligohydramnios resulting from rupture of membranes. Cord compression-induced vagal stimulation is also decreased. These probably decrease further meconium passage as well as remove a stimulus for deep fetal breathing and gasping. IAI also has a dilution effect on the meconium. Thus, it decreases meconium in the trachea and reduces the incidence of MAS and birth asphyxia.

Conclusion

We found that the CS rate in the amnioinfusion group was significantly less as compared to the control group. The rate of meconium aspiration syndrome and respiratory distress was also significantly less in the study group as compared to the control group. There was no increase in maternal and neonatal infection rates and other complications due to amnioinfusion in our study. Therefore, intrapartum intrauterine amnioinfusion is a beneficial procedure using simple equipment in the absence of modern electronic fetal-monitoring facilities especially in low-resource settings.

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