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Original Article

Role of Amnioinfusion in Prevention of Meconium Aspiration Syndrome

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Abstract

Amnioinfusion(AI) may prevent meconium aspiration syndrome(MAS).The present study was undertaken to evaluate the role of prophylactic AI in preventing MAS and assess the benefits/complications associated with the procedure.Sixty pregnant women in labour with Meconum stained amniotic fluid(MSAF) were randomised into AI group or the non infusion group.Outcomes were analysed with regards to fetal condition and maternal complications. Results were analysed with paired and non paired t-test,chi square test whichever was applicable. Conclusion: The study supported the theory that amnioinfusion reduces fetal morbidity associated with MSAF as evidenced by significantly fewer infants with low 1-minute Apgar score($p<0.02$), and lesser incidence of meconium below the vocal cords($p < 0.05$).No adverse effects in either mother or fetus related to amnioinfusion were observed.

Keywords: Amnioinfusion, Meconium aspiration syndrome

INTRODUCTION

Meconim aspiration syndrome (MAS) is an important cause of morbidity and mortality in the newborn period.In an Indian study[1], MSAF was found to occur in 7.4% of all deliveries and among these 10.5%of the babies developed MAS.The incidence of infants born with meconium below the vocal cords,lower 1-minute and 5-minute Apgar scores and needing operative delivery is significantly higher with those born through thick MSAF. More than 70%of the cases of MAS develop in patients with thick MSAF[2]. Current methods to prevent MAS include oral DeLee catheter suctioning on delivery of the baby's head and immediate endotracheal intubation and suctioning of meconium before infants first breath in babies born through thick meconium.These approaches will not always prevent meconium aspiration that may occur during labour[3].

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Prophylactic amnioinfusion during labor complicated by meconium has been shown to reduce the incidence of MAS by correcting concurrent oligohydramnios and decreasing vagal stimulation which in turn reduces fetal gasping, and that it dilutes meconium and diminishes the toxic effects of aspiration should it occur[4,5]. AI could specifically be useful in developing countries where organising a cesarean section takes a longer time.Hence,a need was felt to evaluate the role of prophylactic AI in preventing MAS and assess the benefits/complications associated with the procedure and this study was undertaken.

MATERIALS AND METHODS

This study was conducted in the Department of Obstetrics and Gynaecology,Govrnment Victoria Hospital for Women And Children, attached to Andhra Medical College, Visakhapatnam from April 2017 to July 2017. Sixty pregnant women in labour with meconium stained liquor were admitted to the study.Women with the following conditions were excluded from the study: severe fetal bradycardia, intrauterine fetal death,multiple gestation, gestational age <34 weeks, fetal presentation other than vertex,diagnosed fetal abnormalities,antepartum haemorrhage, signs of chorioamnionitis, unclean vaginal

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examination outside the hospital prior to admission, cord prolapse, severe preeclampsia, heart disease complicating pregnancy, diabetes complicating pregnancy.Informed written consent was obtained before each woman was randomly allocated to AI group (study group) or the noninfusion group(control group).Randomisation was done according to a table of random numbers by Tippet. All women admitted to the study were examined in detail. This included a history, general physical examination and abdominal examination.Pelvic examination was done to determine cervical dilatation, station of presenting part and to rule out cord prolapse.All women received prophylactic antibiotics as was routinely followed by the treating unit.In the study group AI with normal saline was given through a catheter inserted transcervically under all aseptic precautions.The infusion rate was to deliver 600ml during the first hour and subsequently 180ml/hr until delivery. The AI was stopped just before delivery.Continuous fetal heart rate monitoring was done with the help of external cardiotocograph.During the AI, the mother was kept in the left lateral position. The intrapartum managemaent and mode of delivery as determined by obstetric factors were not altered in both study and control groups.In all women (in the study and control groups)the newborns were subjected to intrapartum suction of the mouth,oropharynx and hypopharynx. At birth before baby took a breath the chest was splinted and baby handed over to the paediatrician. Direct laryngoscopy and tracheal suctioning was done in all babies.Reintubation followed by suctioning was repeated until the returns were free of meconium.All deliveries were attended by neonatologigsts who were unaware of the treatment protocol.Umbilical cord blood pH and electrolyte determination was done.Comparision was done between maternal haemoglobin, total leucocyte count,differential leucocyte count and electrolytes at study entry and at delivery. The fetal heart tracings were coded according to steer et al.Puerperal morbidity was defined as temperature 38.0^0 C (100.4^0 F) or higher, the temperature to occur on any 2 of the first 10 days postpartum, exclusive of the first 24 hours, and was taken by mouth by a standard technique four times daily, and in the post partum period mother was observed for the development of any puerperal morbidity. Newborns were observed in the immediate postnatal period for development of MAS and other neonatal complications.

Outcomes were analyzed with regards to fetal heart tracings, time to delivery, method of delivery, fetal condition including weight, Apgar score at one and five minutes, cord blood pH, electrolytes, presence of meconium below the cords (ascertained by laryngoscopy in all infants), complications including meconium aspiration syndrome confimed by chest X-ray. Comparison between maternal haemoglobin, total leucocyte count, differential leucocyte counts and electrolytes at study entry and at delivery was done. Incidence of puerperal morbidity was analysed.

Stastical Analysis

Results were analysed with paired and non-paired t-test, Chi square test whichever was applicable. A p value of < 0.05 was considered significant. The results are presented as mean ± SEM.

Observations

The subjects belong to a wide age group, i.e 18 to 35 years (Table 1). Gravidity ranged from 1 to 7. The gestational age at the time of delivery ranged from 35.57 to 41.85 weeks. In the group that underwent AI, a mean volume of 594ml (range 250ml to 1150ml) was infused over a mean period of 92.33 ± 8.21 minutes(mean ± SEM) (range 30 - 250 minutes). No cases of cord prolapse or uterine hypertonous during the infusion were noted. 2 of the infants with MAS in the study were preterm(36 weeks) and both belonged to the control group. There was no significant difference between the number of preterm infants in each group developing MAS. Three infants with MAS in the control group had umblical cord ph less than 7.2 while the only infant in the AI group was not acidemic(pH 7.28). Three infants in the control group and the only infant in the AI group with MAS were delivered by lower segment cesarean section, while one infant in the control group with MAS was delivered vaginally. Of the 5 infants who developed MAS, 2 infants were born asphixated and both belonged to the control group, however none developed hypoxic ischemic encephalopathy. None of the infants required ventilation or developed seizures, had air leak sydrome or developed persistant pulmonary hypertension. No infant suffered from sepsis. 1 infant in the AI group developed meconium gastritis. There were no neonatal deaths. There was 1 small for date infant(< - 2 SD) in the control group who was acidemic. The one large for date(> ±2 SD) infant in the control group was acidemic as was the only large for date infant in the AI group. All the women in the control group who developed puerperal pyrexia were delivered by lower segment cesarean section, while 1 patient in the AI group had a normal vaginal delivery. The woman who had a normal vaginal delivery had a duration of rupture of membranes of 405 minutes. Puerperal pyrexia developed on the second postpartum day and subsided on the 4^{th} postpartum day with routine antibiotics.

Thus the incidence of infants with lower 1 min Apgar scores and meconium below the vocal cords was significantly reduced in the AI group as compared to the control group (Tables 2-12).

Table 1: Maternal characteristics

Characteristic	Total (*n*=60)	Control group (*n*=30)	Amnion Fusion group	Significance
Age (years)	26.60±0.5	27.57±0.68	25.63±0.71	NS
Gravidity	2.18±0.19	2.40±0.33	1.97±0.21	NS
Gestational age (wk)				
34-36.99	7 (11.67)	5 (16.67)	2 (6.67)	NS
37-39.99	36 (60)	16 (53.33)	20 (66.67)	NS
40&above	17 (28.33)	9 (30)	8 (26.67)	NS
Cx dilation				
≤ 4	44 (73.3)	24 (80)	20 (66.67)	NS
5-8	16 (26.67)	6 (20)	10 (33.33)	NS

Data are presented as mean±SEM or number and percentage. Data in parentheses indicate percentages. NS:Not significant

Table 2: Maternal and pregnancy risk factors

S.No.	Compliaction	Control group	AI group	Significance
Maternal complication				
1	Anaemia	7 (23.33)	8 (26.67)	NS
2	Mild hypertension	3 (10)	8 (26.67)	NS
3	Previous LSCS	4 (13.33)	4 (13.33)	NS
4	Bronchial asthma	3 (10)	0	NS
5	No prenatal care	3 (10)	0	NS
Pregnancy complications				
1	Post datism	9 (30)	8 (26.67)	NS
2	Preterm labor			
	Spontaneous	3 (10)	2 (6.67)	NS
	Induced	2 (6.67)	0	NS
3	Intrautrine growth retardation (IUGR)	1 (3.33)	0	NS

Data in parentheses indicate percentages. LSCS: Lower segment cesarean section. NS: Not significant

Table 3: Labor characteristics

Characteristic	Total (*n*=60)	Control group (*n*=30)	Amnion fusion group (*n*=20)	Significance
Use of oxytocin	20 (33.33)	13 (43.33)	29 (96.66)	NS
Character of meconium (Thick)	53 (88.33)	24 (80)	29 (96.67)	NS
Time from meconium diagnoses to delivery (min)				
30-60	14 (23.33)	9 (30)	5 (16.67)	NS
61-120	35 (58.33)	17 (56.67)	18 (60)	NS
121&above	11 (18.33)	4 (23.33)	7 (23.33)	NS
Time from infusion to delivery (min)				
30-60	NA	NA	9 (30)	
61-120	NA	NA	15 (50)	
121&above	NA	NA	6 (20)	
Fetal distress	11 (18.33)	7 (23.33)	4 (13.33)	NS

Data in parentheses indicate percentages. NS: Not significant. NA: Not applicable

Table 4: Mode of delivery

Characteristic	Total (*n*=60)	Control group (*n*=30)	Amnion fusion group (*n*=30)	Significance
Spontaneous vertex delivery	7 (20)	5 (16.67)	7 (23.33)	NS
Forceps delivery	3 (5)	2 (6.67)	1 (3.33)	NS
Cesarean section	45 (75)	23 (76.67)	22 (73.33)	NS

Data in parentheses indicate percentages. NS: Not significant

DISCUSSION

MAS is an important cause of neonatal morbidity and mortality. Current obstetric and pediatric practices are not able to eliminate the occurrence of this disease altogether. Wenstrom and Parsons[4] initially proposed intrapartum AI as a way of diluting meconium to decrease the incidence of MAS. Majority of the women included in the present study were nulliparous. Term deliveries occurred in nearly 90% of the women. A slightly lower incidence of prerterm delivery could be explained by the fact that only women of gestation > 34 weeks were included in the study. The

Table 5: Birth weights

Characteristic	Total (*n*=60)	Control group (*n*=30)	Amnio infusion group (*n*=30)	*P* value
Birth weight	2.93±0.08	2.85±0.01	3.01±0.11	NS
Low birth Weight (<2.5 kg)	14 (23.33)	11 (36.67)	29 (96.67)	*P*<0.02
Appropriate for date	57 (95)	28 (93.33)	29 (96.67)	NS
Small for date	1 (1.67)	1 (3.33)	0	
Large for date	2 (3.33)	1 (3.33)	1 (3.33)	

Data is presented as mean±SEM or number and percentage. Data in parentheses indicate percentages. NS: Not significant

Table 6: APGAR score

Characteristic	Total (*n*=60)	Control group (*n*=30)	Amnio infusion group (*n*=30)	*P* value
1 min APGAR				
0-3	4 (6.67)	3 (10)	1 (3.33)	
4-6	7 (11.67)	6 (20)	1 (3.33)	<0.02
7-10	49 (81.67)	21 (70)	28 (93.33)	
5 min APGAR				
0-3	0	0	0	
4-6	0	0	0	
7-10	60 (100)	30 (100)	30 (100)	NS

Data in parentheses indicate percentages. NS: Not significant

Table 7: Cord blood studies

Characteristic	Total (*n*=60)	Control group (*n*=30)	Amnio infusion group (*n*=30)	*P* value
Cord blood ph	7.27±0.2	7.28±0.3	7.27±0.2	NS
≤7.16	9 (15)	5 (16.66)	4 (13.33)	
7.17-7.2	11 (18.33)	8 (26.66)	3 (10)	
7.21&above	40 (66.66)	17 (56.66)	23 (76.66)	NS
Cord blood electrolytes				
Sodium (meq/L)	135.18±0.63	135.40±1.02	134.97±0.75	NS
Potassium (meq/L)	4.33±0.11	4.32±0.15	4.34±0.17	NS
Chloride (meq/L)	98.80±0.56	98.27±0.86	99.33±0.72	NS

Data is presented as mean±SEM or number and percentage. Data in parentheses indicate percentages. NS: Not significant

Table 8: Neonatal complications

Characteristic	Total (*n*=60)	Control group (*n*=30)	Amnio infusion group (*n*=30)	*P* value
Meconium below the cords				
Present	15 (25)	11 (36.67)	4 (13.33)	
Absent	45 (75)	19 (63.33)	26 (86.33)	<0.05
Meconium aspiration syndrome				
Present	5 (8.33)	4 (13.33)	1 (3.33)	
Absent	55 (91.67)	26 (86.67)	29 (96.67)	NS

Data in parentheses indicate percentages. NS: Not significant

Table 9: Correlation of birth weight and cord pH in appropriate for date infants

Characteristic	Control group (n=28)	Amnio Infusion group (n=29)	Significance
Umblical Cord pH			
≤7.16	5	3	
7.17-7.2	6	3	
7.21&above	17	23	NS

NS: Not significant

cervical dilatation at the time of detection of meconium was similar in both groups of women(a mean of 3.47 cms in the control group and 4.23 cms in the AI group). This was similar to the cervical dialtation at detection of meconium in the studies reported by Macri et al[6] and Eriksen et al[7]. Hyperstimulation characterised by excessive frequency and intensity of contractions and FHR abnormalities is a known complication with oxytocin. In the present study 33.33% of the women who had meconium staining were given oxytocin for induction/augmentation of labor. In the obstetric practices in this institute since other methods to evaluate fetal distress are not available more often cesarean section is resorted to for women laboring with MSAF, and hence the mean time from meconium diagnosis to delivery and mean duration of AI was shorter in this study as compared to the studies reported from the west[4,5,7]. The

Table 10: Maternal haematological and bio chemical parameters

Characteristics	Total (*n*=60)	Control group (*n*=30)	Amnio infusion group (*n*=30)	Significance
Predelivery				
Haemoglobin (g/dl)	11.24±0.26	11.48±0.37	10.99±0.38	NS
TLC	11830±473.46	11610±536.19	12050±788.21	NS
Neutrophil	72.92±1.24	72.93±1.93	72.90±1.58	NS
Lymphocyte	21.35±0.96	22.00±1.70	20.70±0.91	NS
At delivery				
Haemoglobin (g/dl)	10.29±0.25	10.40±0.32	10.17±0.38	NS
TLC	11338.33±378.3	11386.67±586.92	11290.0±487.51	NS
Neutrophil	73.53±1.07	73.50±1.58	73.57±1.48	NS
Lymphocyte	19.02±0.79	19.43±1.20	18.60±1.06	NS
Predelivery Electrolytes:				
Sodium (meq/L)	135.42±0.65	135.40±0.81	135.43±1.03	NS
Potassium (meq/L)	3.97±0.07	3.99±0.10	3.96±0.12	NS
Chloride (meq/L)	97.68±0.52	97.70±0.65	97.67±0.82	NS
At delivery electrolytes				
Sodium (meq/L)	135.52±0.65	134.73±0.87	136.30±0.96	NS
Potassium (meq/L)	3.80±0.15	3.70±0.24	3.90±0.18	NS
Chloride (meq/L)	97.37±0.52	96.97±0.74	97.77±0.73	NS

Data are presented as mean±SEM TLC: Total leucocyte count, NS: Not significant

Table 11: Maternal laboratory parameters in AI group

Characteristic	Pre infusion	Post Infusion	Significance
Haemoglobin	10.99±0.38	10.17±0.38	<0.02
TLC	12050±788.21	11290±487.51	NS
Neutrophil	72.90±1.58	73.57±1.48	NS
Lymphocyte	20.70±0.91	18.60±1.06	NS
Sodium (meq/L)	135.43±1.03	136.30±0.96	NS
Potassium (meq/L)	3.96±0.12	3.90±0.18	NS
Chloride (meq/L)	97.67±0.82	97.77±0.73	NS

Data is presented as mean±SEM. NS: Not significant, TLC: Total leucocyte count

Table 12: Postpartum data

Characteristic	Control group (*n*=30)	Amnion fusion group	Significance
Puerperal Pyrexia	6 (20)	5 (16.66)	NS

Data in parentheses indicate percentages. NS: Not significant

mean duration of infusion was 92.33 minutes in the present study compared to the reported duration of infusion of 3.5 to 6.5 hrs in other studies[4,5,7]. Fetal distress as diagnosed by abnormal FHR tracings was diagnosed in 23.33% of the women belonging to the control group and 13.33% of the women belonging to the AI group. There was no significant difference in the incidence of late and variable decelerations between the study and control groups. These observations are similar to those of Sadovsky et al[5] and Eriksen et al[7]. In the present study 1-minute Apgar score < 7 occurred in 30% of the control group infants vs 6.66% of the AI group infants, a significant difference($x^2 = 5.46$; $p < 0.02$). However, there was no significanion characterised byt difference in the number of infants with 5-min Apgar score < 7 between the two groups. Wenstrom et al[4] had reached a similar conclusion. Aspiration of meconium occurs as a result of hypoxia and hypercarbia, which act synergistically to stimulate fetal gasping[8]. In the present study, the mean umbilical cord pH at delivery was similar between the study and the control groups. There was also no significant difference in the number of appropriate for date infants who were acidemic between the two groups. These observations are consistent with the studies of Wenstrom et al[4], Eriksen et al[7]. In the fetus, potential for solute exchange exists via breathing, swallowing and skin(particularly in preterm fetuses), as well as across the chorionic plate. In this study cord blood electrolytes determined at delivery were similar between the 2 groups. Similar results were reported by Wenstrom et al[4]. In the present study, the incidence of meconium below the vocal cords was significantly reduced in the AI group as compared to the control group(13.33% vs 36.66%, $p < 0.05$). Similar observations have been made by Sadovsky et al[5], Wenstrom et al[4], Eriksen et al[7]. In the present study, MAS developed 13.33% of the infants belonging to the control group as compared to only 3.33% of the infants belonging to the AI group. Though the difference did not reach statistical significance, the results do show a decreased trend towards the development of MAS in the AI group. This is similar to the observations made by Wenstrom et al[4], Eriksen et al[7]. In Sadovsky's[5] study no new born in either group developed MAS. Postpartum endometritis might be expected to be increased in the women undergoing AI. In the present study, puerperal pyrexia developed in 16.66% of the AI group women as compared to 20% of the control group women, the difference not being statistically significant. The higher incidence of puerperal pyrexia in our study could be explained by the fact that 75% of the women with MSAF had cesarean section. This is similar to the observations by Wenstrom et al[4], Sadovsky et al[5], Eriksen et al[7].

CONCLUSION

This study was undertaken to determine the role of AI in the prevention of MAS. From the results and review of literature it appears that AI has a definitive role in reducing the incidence of meconium below vocal cords as well as improving Apgar scores at 1-minute.

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