Transcervical Amnioinfusion

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Abstract: ***Background:*** **Transcervical amnioinfusion is a new and relatively safe, simple procedure that can be performed in most modern hospital maternity units.**

Methods: **We reviewed the current medical literature concerning this topic by searching MEDLINE files from 1987 to the present, using key words "amnioinfusion," "fetal distress," "premature rupture of membranes," "meconium aspiration," and "oligohydramnios." Older articles were accessed from cross-reference of the more recent publications.**

Results: **When amnioinfusion was used to treat variable fetal heart rate decelerations, it usually reduced the severity of the decelerations, as well as the Cesarean section rate for fetal distress. Prophylactic transcervical amnioinfusion has been studied in three other settings: premature rupture of membranes, meconium passage during labor, and oligohydramnios. A suggested protocol for saline amnioinfusion during labor is given.**

Conclusions: **Further studies are needed to confirm efficacy reports and to clarify the indications for saline amnioinfusion. (J Am Board Fam Pract 1993; 1:43-8.)**

The normal leakage of amniotic fluid during labor seldom causes fetal problems. Variable fetal heart rate (FHR) decelerations, however, can occur when the fluid volume is low enough to permit umbilical cord compression.[1] These decelerations, if severe and repetitive, can indicate fetal asphyxia.[2] The management of severe variable FHR decelerations includes changing maternal position, administering maternal oxygen, elevating the fetal presenting part, and performing vaginal or abdominal delivery.[3] Recently, transcervical saline amnioinfusion has been used to treat variable FHR decelerations, potentially reducing the Cesarean section rate for fetal distress. The procedure could be beneficial in preventing other complications of pregnancy, such as premature rupture of membranes, oligohydramnios, postpartum endometritis, and meconium aspiration syndrome.[4,5]

Illustrative Case

A 30-year-old woman, gravida 2, para 1, at 34 weeks' gestation was admitted to the hospital having had premature rupture of membranes 5 hours earlier. Her prenatal course had been complicated by preterm labor and cervical incompetence at 22 weeks' gestation, necessitating cervical cerclage and treatment with indomethacin. At 24 weeks' gestation, a sonogram showed mild oligohydramnios, and indomethacin was discontinued. The patient was then treated with a continuous infusion of subcutaneous terbutaline. A repeat sonogram at 32 weeks' gestation showed normal interval fetal growth. The volume of amniotic fluid was estimated to be at the lower limit of normal. On her admission to the hospital the cerclage was removed, oxytocin augmentation was begun, and she began having active contractions.

While the patient was progressing through latent labor, we noted variable FHR decelerations. When the patient's cervix was dilated approximately 3 cm, an epidural block was placed to alleviate discomfort. A fetal scalp electrode and an intrauterine pressure catheter were placed to monitor FHR and uterine contractions. The monitor registered one prolonged episode of fetal bradycardia (Figure 1A). A second intrauterine pressure catheter was placed, and amnioinfusion with normal saline was begun. The amnioinfusion reduced both the frequency and depth of variable FHR decelerations for the remainder of the first stage of labor (Figure 1B – 1E). In the second stage of labor, however, the FHR tracing showed recurrent variable decelerations and terminal bradycardia to 80 beats per minute for 5 minutes

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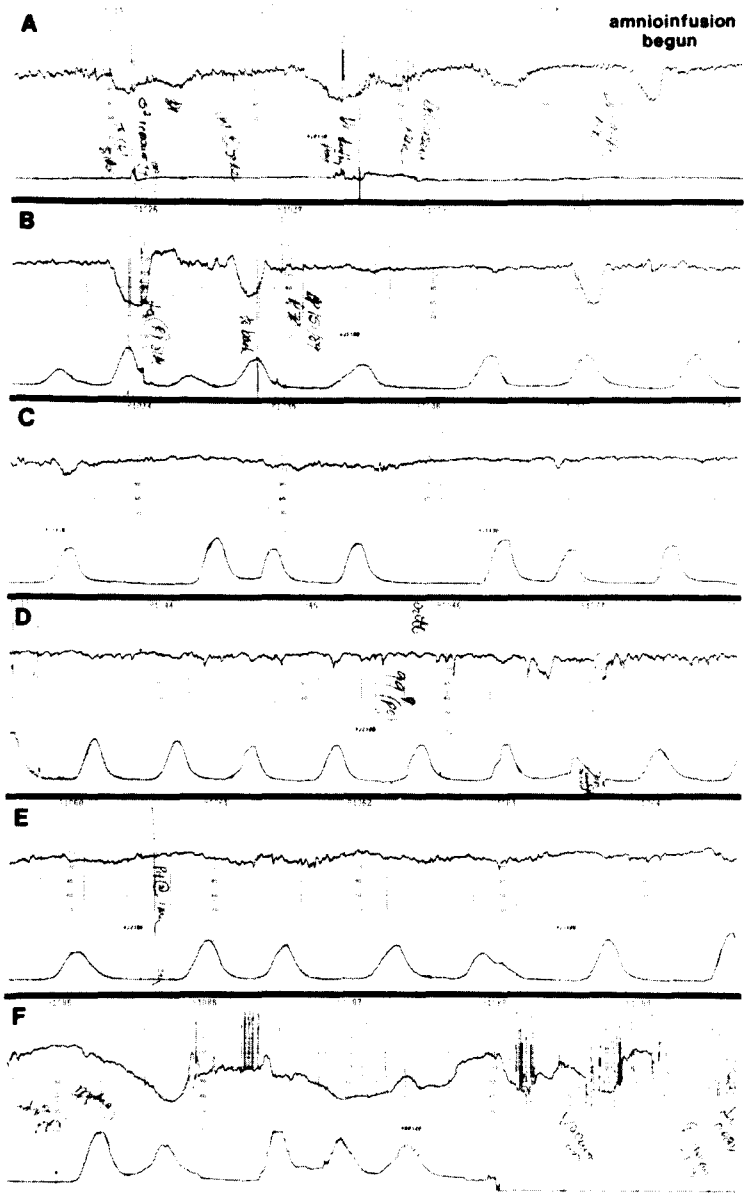

Figure 1. Ten-minute segments of fetal-monitoring strip from the patient presented in the text: (A) a few minutes before amnioinfusion, (B) 30 minutes after amnioinfusion was begun, (C) 60 minutes after amnioinfusion was begun, (D) 90 minutes after amnioinfusion was begun, (E) 150 minutes after amnioinfusion was begun, (F) and at delivery, 230 minutes after amnioinfusion was begun.

(Figure 1F). The baby was delivered by vacuum extraction a few minutes later.

At delivery, a tight nuchal cord was reduced without difficulty. Umbilical cord blood gases were normal and infant Apgar scores were 7 at 1 minute and 8 at 5 minutes. Both patients did well and had routine hospital courses.

Methods

We reviewed the current literature concerning this topic by using Grateful Med software to search MEDLINE files from 1987 to the present. The key words "amnioinfusion," "fetal distress," "premature rupture of membranes," "meconium aspiration," and "oligohydramnios" were used. Older articles were accessed from cross reference of the more recent publications.

Saline Amnioinfusion for Variable FHR Decelerations

The first reported use of transcervical saline amnioinfusion was in 1983.[6] At that time, Miyazaki and Taylor performed saline amnioinfusion on 42 patients, 14 with prolonged FHR decelerations and 28 with repetitive variable FHR decelerations. The FHR pattern returned to normal in 12 of the 14 patients with prolonged FHR decelerations and 19 of the 28 with variable FHR decelerations. This study was not randomized or controlled; therefore, the effect on fetal outcome and Cesarean section rate could not be determined. The authors did note, however, that the procedure was a safe, simple, and effective treatment for variable FHR decelerations.

Two years later the same group published a prospective, randomized study of 96 cases of repetitive variable FHR decelerations not relieved by changes in maternal position or oxygen administration.[7] These patients were randomly assigned to either a saline amnioinfusion group or a nontreated control group. Patients within each group were further stratified by parity. The outcome measurements included complete relief of variable FHR decelerations, Cesarean section rate for fetal distress, and infant Apgar scores. Statistically significant differences were noted in the Cesarean section

rate in the nulliparous patients who received amnioinfusion and in the relief of variable FHR decelerations in all patients in the infusion group. Apgar scores were similar between the study and control cases.

More recently Owen, et al.[8] have researched the use of saline amnioinfusion in patients who either demonstrated variable FHR deceleration during labor or were at risk for umbilical cord compression resulting from the following complications: (1) post-term pregnancy, (2) preterm labor with ruptured membranes, and (3) oligohydramnios. Their results showed a significantly lower rate of postpartum endometritis and a lower, but not significantly different, Cesarean section rate in the study patients. They concluded that the technique was safe and might be beneficial, but they suggested that more studies were warranted before they could make a general use recommendation.

During the last few years several researchers have attempted to pick out candidates for saline amnioinfusion by defining the characteristics of patients at risk for developing severe variable FHR decelerations. By using the amniotic fluid index, a semiquantitative sonographic assessment of amniotic fluid volume, Sarno and others[9] showed that patients with values less than 5 cm were at increased risk for Cesarean section for fetal distress, and their infants were more likely to have severe variable FHR decelerations during labor and 1 minute Apgar scores of less than 7. Strong, et al.[10] demonstrated that a saline amnioinfusion of 250 mL will increase the amniotic fluid index by an average of 4.3 cm, which for most patients will correct the amniotic fluid loss. Chauhan observed a similar increase in the amniotic fluid index in 21 patients treated with a 250 mL saline amnioinfusion.[11] Macri, et al.[12] showed a lower rate of fetal distress, higher cord blood pH, and a lower Cesarean section rate in patients in whom saline amnioinfusion was used to maintain an amniotic fluid volume greater than 10 cm.

Prophylactic Use of Saline Amnioinfusion

Prophylactic use of transcervical saline amnioinfusion has been studied in three settings: premature rupture of membranes (PROM), meconium passage during labor, and oligohydramnios. In 1985 Nageotte, et al.[13] reported their results of a prospective randomized trial of saline amnioinfusion in patients with PROM. Sixty-one patients with fetal mean gestational age of 31 weeks were studied. Twenty-nine women received amnioinfusion while the remainder served as controls. Statistically significant differences were noted in the number of severe FHR decelerations in both the first and second stages of labor and in the number of mild and moderate FHR decelerations in the first stage of labor. Mean umbilical cord blood pH was also significantly higher in the treatment group compared with the control group. There were no differences in the Cesarean section rates. They concluded that amnioinfusion for PROM was beneficial with respect to umbilical cord pH and FHR decelerations.

In Japan, Ogita and others[14,15] have developed a new transcervical catheter (PROM-fence) designed to remain in place for several days in patients with PROM. The catheter allows infusion of saline or other solutions into the amniotic cavity while plugging the rupture. In one study, 84 patients were treated with a continuous infusion of a saline solution containing a cephalosporin antibiotic. During a 6.5-day (average) course, they noted a drop in the incidence of positive amniotic fluid cultures from 39 percent to 4 percent. There were no apparent complications, and although there was no control group for comparison, they reported a 4.8 percent infection rate in the newborns compared with a reported infection rate in the literature of 26.5 percent in neonates receiving "expectant management."

Wenstrom and Parsons[4] conducted a prospective randomized study on the prevention of meconium aspiration syndrome by saline amnioinfusion. In this study 36 out of 85 patients were selected to receive amnioinfusion plus routine care. Neonates in the study group had significantly better 1-minute Apgar scores and less meconium below the vocal cords. Mothers had significantly fewer operative deliveries. Sadovsky, et al.[16] conducted a similar randomized, controlled study of prophylactic amnioinfusion in 21 of 40 women with labor complicated by meconium. Neonates in the amnioinfusion study group had significantly higher cord blood pH and less meconium below the vocal cords. They were also less likely to need positive pressure ventilation after birth. There was a lower, although not signifi-

cantly different, Cesarean section rate in the amnioinfusion group.

Strong, et al.[5] studied 60 women in latent labor who had oligohydramnios. These patients were randomized to receive standard therapy or saline amnioinfusion. The study group had significantly less frequent meconium passage, fewer severe variable FHR decelerations, less frequent end-stage fetal bradycardia, and fewer Cesarean sections for fetal distress. At delivery, the neonates in the study group had significantly higher cord blood pH, but no differences in Apgar scores. In a randomized, controlled trial of 297 women with oligohydramnios, Schrimmer, et al.[17] also reported a significantly lower rate of operative deliveries and higher neonatal cord blood pH in those mothers treated prophylactically with saline amnioinfusion. In a smaller randomized, controlled study of 26 women with term or post-term pregnancies complicated by oligohydramnios, prophylactic amnioinfusion significantly decreased the rate of severe variable FHR decelerations. There were also fewer Cesarean section deliveries for fetal distress in the treatment group, although the difference was not significant at the $P < 0.05$ level.[18]

Method of Saline Amnioinfusion

A suggested protocol for saline amnioinfusion for the relief of repetitive variable decelerations during labor has appeared in the medical literature.[19] When confronted with severe variable FHR decelerations in a laboring patient, Galvan, et al. recommend first performing a vaginal examination to exclude a prolapsed cord. Following this examination the procedure is explained to the patient and consent obtained. An intrauterine pressure catheter is placed and attached via an extension tube to the transducer. A 1000-mL bag of 37°C 0.9 normal saline is connected to standard intravenous tubing fitted with an 18-gauge needle, which is then inserted into the side port of the extention tubing (Figure 2, left). Alternatively, a second intrauterine catheter can be placed, and the intravenous tubing connected directly to this catheter (Figure 2, right).

Initially 250 to 500 mL of fluid is infused over 20 to 30 minutes. The rate is then adjusted according to the severity of the decelerations and amount of vaginal fluid leakage. In the previously mentioned studies, the infusion rate varied from 160 to 180 mL/h. Miyazaki and Nevarez[7] noted that if a single catheter is used, there will be a 35- to 40-mmHg artifactual increase in the intrauterine pressure reading, possibly because of resistance to outflow of the infusate through the catheter holes. This increase in pressure does not occur if the infusion is run directly through a second catheter. A double-lumen catheter is also available (Intran II, Utah Medical Products, Midvale, Utah), eliminating the need to place two catheters.

Although the procedure is considered safe, it is important to monitor the intrauterine pressure. respiratory failure, iatrogenic polyhydramnios, and elevated intrauterine pressure have been reported. Dragich, et al.[20] described a patient with respiratory failure associated with amnioinfusion. Tabor and Maier[21] reported a case of polyhydramnios during a prolonged amnioinfusion that responded to removal of amniotic fluid and administration of subcutaneous terbutaline. Sorensen, et al.[22] also reported a case of amnioinfusion-related iatrogenic polyhydramnios that responded to removal of the excess fluid.

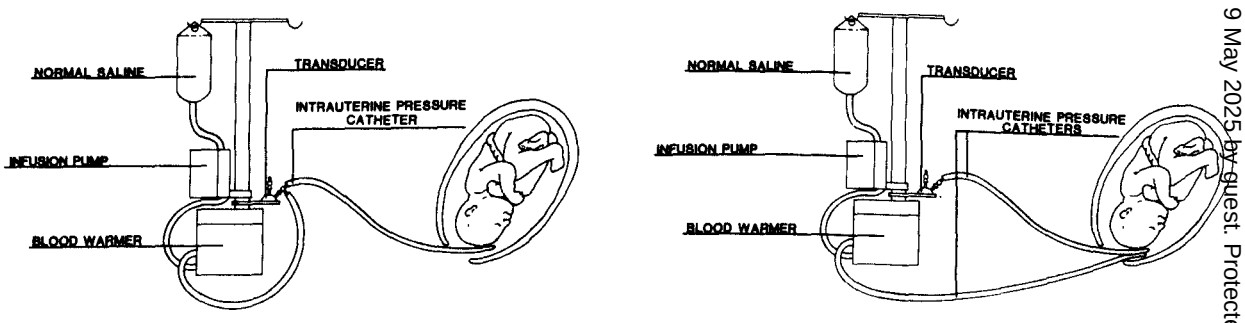

Figure 2. Left: Single-catheter method of transcervical amnioinfusion. Right: Double-catheter method of transcervical amnioinfusion.

In a study of the effect of amnioinfusion on uterine pressure and activity, Posner, et al.[23] noted that an infusion of 250 mL of saline caused a 5-mmHg increase in uterine tone without affecting the contraction pattern. This increase in tone was accompanied by an average increase of 4.6 cm in the amniotic fluid index. In their limited study of 10 patients, 1 did develop uterine hyperactivity that responded to intravenous administration of magnesium sulfate.

Based on their experience, Posner, et al. have recommended that all patients treated with amnioinfusion be objectively monitored. They chose to measure intrauterine pressure with a second catheter. They also measured amniotic fluid volume sonographically, aiming for an amniotic fluid index of approximately 8 cm. Schrimmer, et al.[24] found that in patients with oligohydramnios, amnioinfusions of 500 mL of saline were well tolerated, and the authors believed that sonographic assessment of the amniotic volume every 3 hours was appropriate.

A summary of indications and contraindications for amnioinfusion is listed in Table 1. Patients with conditions listed under contraindications were excluded from the studies cited in this paper. Pending future investigations, therefore, amnioinfusion should not be performed on these patients. A previous low cervical transverse Cesarean section is not a contraindication. Strong, et al.[25] noted no complications of amnioinfusion among 18 women attempting vaginal delivery after Cesarean section.

Table 1. Indications and Contraindications for Transcervical Amnioinfusion.

Indications
Repeated variable FHR decelerations not responsive to conventional therapy
Premature rupture of membranes
Thick meconium staining of the amniotic fluid
Oligohydramnios
Contraindications
Amnionitis
Polyhydramnios
Uterine hypertonus
Multiple gestation
Known fetal anomaly
Known uterine anomaly
Severe fetal distress
Nonvertex presentation
Fetal scalp pH < 7.20
Placental abruption or placenta previa
Patient refusal or uncooperative patient

Conclusion

Transcervical saline amnioinfusion is a relatively safe and simple procedure that can be performed in most modern hospital maternity units. Although no study to date has shown definite improvement in long-term neonatal outcome, most have reported a reduction in Cesarean section rates and intrapartum fetal distress. The procedure might lower the rate of postpartum endometritis, presumably by continuously irrigating the intrauterine space with sterile fluid.[8] Antibiotics added to the infusate are not known to be harmful to the fetus; however, there are no controlled studies to support their use. Saline amnioinfusion could be a useful adjunct in managing pregnancies complicated by oligohydramnios and PROM. It might also help prevent meconium aspiration syndrome. Future studies are expected to clarify further the role of saline amnioinfusion in labor management. Family physicians who are not familiar with the procedure should consider consulting an obstetrician before performing saline amnioinfusion.

References

1. Gabbe SG, Ettinger BB, Freeman RK, Martin CB. Umbilical cord compression associated with amniotomy: laboratory observations. Am J Obstet Gynecol 1976; 126:353-5.
2. Parer JT, Livingston EG. What is fetal distress? Am J Obstet Gynecol 1990; 162:1421-7.
3. Depp R. Clinical evaluation of fetal status. In: Danforth DN, Scott JR, editors. Obstetrics and gynecology. 6th ed. Philadelphia: J.B. Lippincott, 1990:315-34.
4. Wenstrom KD, Parsons MT. The prevention of meconium aspiration in labor using amnioinfusion. Obstet Gynecol 1989; 73:647-51.
5. Strong TH Jr, Hetzler G, Sarno AP, Paul RH. Prophylactic intrapartum amnioinfusion: a randomized clinical trial. Am J Obstet Gynecol 1990; 162:1370-5.
6. Miyazaki FS, Taylor NA. Saline amnioinfusion for relief of variable or prolonged decelerations. Am J Obstet Gynecol 1983; 146:670-8.
7. Miyazaki FS, Nevarez F. Saline amnioinfusion for relief of repetitive variable decelerations: a prospective randomized study. A preliminary report. Am J Obstet Gynecol 1985; 153:301-6.
8. Owen J, Henson BV, Hauth JC. A prospective randomized study of saline solution amnioinfusion. Am J Obstet Gynecol 1990; 162:1146-9.

9. Sarno AP, Ahn MO, Phelan JP. Intrapartum amniotic fluid volume at term. Association of ruptured membranes, oligohydramnios and increased fetal risk. J Reprod Med 1990; 35:719-23.
10. Strong TH Jr, Hetzler G, Paul RH. Amniotic fluid volume increase after amnioinfusion of a fixed volume. Am J Obstet Gynecol 1990; 162:746-8.
11. Chauhan SP. Amniotic fluid index before and after amnioinfusion of a fixed volume of normal saline. J Reprod Med 1991; 36:801-2.
12. Macri CJ, Schrimmer DB, Leung A, Greenspoon JS, Paul RH. Amnioinfusion improves outcome in labor complicated by meconium and oligohydramnios. Am J Obstet Gynecol 1991; 164:252. Abstract no. 23.
13. Nageotte MP, Freeman RK, Garite TJ, Dorchester W. Prophylactic intrapartum amnioinfusion in patients with preterm premature rupture of membranes. Am J Obstet Gynecol 1985; 153:557-62.
14. Ogita S, Mizuno M, Takeca Y, Arai M, Sugawa T, Kuwabara Y, et al. Clinical effectiveness of a new cervical indwelling catheter in the management of premature rupture of the membranes: a Japanese collaborative study. Am J Obstet Gynecol 1988; 159:336-41.
15. Imanaka M, Ogita S. New technologies for the management of preterm premature rupture of membranes. Obstet Gynecol Clin North Am 1992; 19:365-86.
16. Sadovsky Y, Amon E, Bade ME, Petrie RH. Prophylactic amnioinfusion during labor complicated by meconium: a preliminary report. Am J Obstet Gynecol 1989; 161:613-7.
17. Schrimmer DB, Macri CJ, Paul RH. Prophylactic amnioinfusion as a treatment for oligohydramnios in laboring patients: a prospective, randomized trial. Am J Obstet Gynecol 1991; 165:972-5.
18. Nageotte MP, Bertucci L, Towers CV, Lagrew DL, Modanlou H. Prophylactic amnioinfusion in pregnancies complicated by oligohydramnios: a prospective study. Obstet Gynecol 1991; 77:677-80.
19. Galvan BJ, Van Mullem C, Broekhuizen FF. Using amnioinfusion for the relief of repetitive variable decelerations during labor. J Obstet Gynecol Neonatal Nurs 1989; 18:222-9.
20. Dragich DA, Ross AF, Chestnut DA, Wenstrom K. Respiratory failure associated with amnioinfusion during labor. Anesth Analg 1991; 72:549-51.
21. Tabor BL, Maier JA. Polyhydramnios and elevated intrauterine pressure during amnioinfusion. Am J Obstet Gynecol 1987; 156:130-1.
22. Sorensen T, Sobeck J, Benedetti T. Intrauterine pressure in acute iatrogenic hydramnios. Obstet Gynecol 1991; 78:917-8.
23. Posner MD, Ballagh SA, Paul RH. The effect of amnioinfusion on uterine pressure and activity: a preliminary report. Am J Obstet Gynecol 1990; 163:813-8.
24. Schrimmer DB, Macri CJ, Paul RH. Amnioinfusion: an evaluation of one center's technique. Am J Obstet Gynecol 1991; 164:305. Abstract no. 215.
25. Strong TH, Vega JS, O'Shaughnessy MJ, Feldman DB, Koemptgen JG. Amnioinfusion among women attempting vaginal birth after Cesarean section. Obstet Gynecol 1992; 79:673-4.