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Extraovular placement of intrauterine pressure catheters in laboring patients

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SUMMARY

Intrauterine catheters placed in pregnant laboring women to monitor contractions are often inserted outside the amniotic membranes without the clinician's recognition. The significance of these findings are that it can result in artifactual. pressure readings and complications such as placental perforation or abruption, uterine perforation, fetal heart rate tracing abnormalities, and placental abruption due to amnioinfusion outside the membranes.

INTRODUCTION

It is common obstetrical clinical practice in the complicated pregnant or obese laboring patient to directly monitor intrauterine contraction strength by placing a pressure. catheter into the uterine cavity. Internal monitoring provides diagnostic information which is useful to assess the pressures generated by the myometrium and together with FHR to follow the well-being of a fetus during labor and delivery. The intention when monitoring

intrauterine pressure is to measure the pressure exerted on the fetus and the amniotic fluid to effect dilation, effacement and expulsion. To accomplish this, the intrauterine pressure catheter is assumed to be placed into the amniotic fluid space. Intrauterine pressure catheters (IUPCs) may inadvertently be placed outside the amniotic membranes or

extraovular between the chorioamniotic membrane and the decidua (endometrial lining). This placement outside the chorion may result in improper amnioinfusion and in damped waveform readings and adverse complications.1-3

When placing IUPCs, it is assumed that the catheter is within the amniotic cavity with the fetus. Little consideration is given to possible placement between the uterine wall and the amniotic/chorionic membranes. When extraovular catheter placement happens, major complications can occur. The complications of intrauterine pressure catheter insertion are documented and include placental perforation,4 fetal vessel laceration,5 placental abruption,6 uterine rupture,7 and amnionitis.8 Sciscione et al.,9 suggest patient selection and proper technique are needed to minimize placental abruption when placing intrauterine pressure catheters. The complications associated with amnioinfusion include amnionitis, hypertonus, uterine rupture, and FHR abnormalitles.10 Many of these complications may be related to extraovular placed catheters. Recently, a case study was reported of partial placental abruption followed by disseminating intravascular coagulation (DIC) which was caused by an extraovular placed fluid-filled intrauterine pressure catheter.11

No study has yet quantified the percent of extraovular placements of these catheters nor has addressed changes in technique to decrease this occurrence and the resulting sequela potentially caused by extraovular placed catheters. The purpose of this study was to determine the frequency of extraovular placement.

MATERIALS AND METHODS

The study followed standard hospital protocol for placing intrauterine pressure catheters. Only laboring pregnant women for whom intrauterine pressure catheters were clinically indicated were used in the study. Critically ill pregnant women or women whose babies had acute fetal compromise were not included. The study was done over a 14 month period. All catheters were placed by the same physician with approximately 20 years experience in placing IUPCs. Three different intrauterine pressure catheter types were used.* A total of 73 patients participated in the study with a breakdown of intrauterine catheters as follows: 39 Koala", 20 Intran Plus and 14 fluid filled Isoflo™. As explained above, the catheters were placed according to standard hospital protocol, except for the following: (1) the catheter was not prefilled with fluid so return of fluid could be visualized through the amniolumen. If amniotic fluid was obtained, the catheter was considered to be within the amniotic cavity, (2) if fluid was not obtained, the catheter was

Koala™ - Trademark of Clinical Innovations. Inc., **Murray**. UT. **Intran™ Plus - Registered Trademark, of Utah Medical Products. Inc- Midvale, UT - Isoflo™ - Trademark of Quest Medical.** Inc - **Allen.** TX.

withdrawn to the fingertips, keeping it in the vagina, and redirectea into a different location. Multiple intrauterine pressure catheter placement attempts with the same catheter were made resulting in one of three end points determined by fluid in the amniolumen: (1) amniotic fluid visualized - confirmation of placement within the amniotic space was assumed when a flashback of amniotic fluid was visualized, (2) blood visualized - gross blood return filling the catheter with onset of abnormal fetal heart rate and intrauterine pressure catheter placement was assumed to be evidence of extraovular placement, (3) no fluid or blood visualized - if no fluid or blood was visualized, tip placement location was evaluated by injecting 5cc of indigo carmine indicator near the time of delivery. After placental delivery, the amniotic fluid, fetus, and chorioamnionic membranes were examined for indigo carmine staining. Examination of the chorionic surface for indigo carmine showed obvious blue staining on its surface if the placement was extraovular. If indigo the carmine was injected into the amniotic space, blue dye was usually on the fetus and was wiped off.

General requirements for the study data collection were: 1) The data was recorded, tabulated, and summarized. Each quantitative category was totaled, averaged, and compared to determine significant differences, and 2) The methods of statistical analysis used were Confidence Limits for a Proportion and the Chi-Square Comparisons of Independent Samples.

RESULTS AND CONCLUSIONS

13.7% of the intrauterine pressure catheters placed were confirmed with indigo carmine or blood to be extraovular placements utilizing the technique of multiple insertions to obtain amniotic fluid. Statistically, in 10% to 18% of patients, the intrauterine pressure catheters were placed outside the amniotic membranes (confidence limit 95%) after multiple placement attempts to obtain a flashback of amniotic fluid. The number of attempts on any one patient to obtain amniotic fluid ranged from one to five. Fluid was obtained upon the first insertion on 45 of the 73 patients (62%). The percentage of confirmed amniotic space placements increased with the number of placement attempts.

- Only 62% of placements were confirmed on the first insertion attempt.
- 77% intra-amniotic placements were realized after the second attempt.
- Three or more attempts yielded an 86% confirmation rate.

Figure 1 illustrates that placement location was unknown (possibly extraovular) in 38% (100-62=38%) of all intrauterine pressure catheters placed upon first insertion. Upon first insertion attempt, the chance of obtaining no fluid flashback was 33% to 44% (confidence limit 95%). It was recognized that even if amniotic fluid was not obtained, this did not absolutely mean the catheter was not in the amniotic space. However, since amniotic fluid flashback only required 1-2cc of fluid, and even in oligohydramnious there should

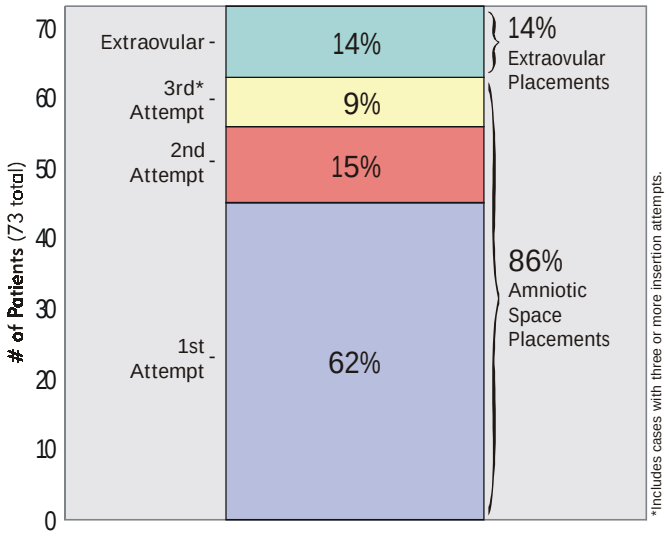

Figure 1. Frequency of extraovular vs. amniotic space intrauterine pressure catheter placements.

be at least 50cc of fluid in the amniotic space. Therefore, finding a 1-2 cc pocket of amniotic fluid should be non-problematic. The rate of these placements declined to 23% after sec ond attempt, and 14% with three pr more attempts which were confirmed extraovular.

The major differences between the catheters were that the Isoflo was a fluid-filled catheter while Intran Plus and Koala are sensor-tipped catheters. Isoflo and Koala catheters have clear material construction so that it is easy to visualize amniotic fluid or blood return through the amniolumen wall. Intran Plus has an amnioport which was left open in order to view the return of fluid. Among the three intrauterine pressure catheter types used, catheter brand did not affect the incidence of extraovular placement. It was more difficult to visualize amniotic fluid-return with the Intran Plus catheters, probably due to the opaque catheter body and to the small amniolumen and the few holes in the catheter tip. In three cases, no fluid was visualized but proper amniotic placement was confirmed with indigo carmine. In the 73 patients of this study, gross blood return was experienced in 7 of the patients. In two of these seven patients the blood return was accompanied by transient bradycardia which resolved upon catheter removal. (One patient had severe variable decelerations which resulted in C-section.) No other problems were encountered in this study.

Placement of intrauterine pressure catheters to monitor uterine contraction strength has become common since the method was introduced by Alvarez and Caldeyro-Barcia in Montevideo, Uruguay.[12] Little or no training is taught to clinicians for proper placement

of these catheters. Clinicians have noted that often poor quality waveforms (damped, high resting tone) are obtained.[13] Clinicians have also noted catheters with blood and endometrial tissue on the tips upon. removal. Little attention has been given to the etiology of these effects.

Through the years, different methods have been used to monitor intrauterine pressure during labor including intra versus extra membranous placement. Casapo,14 Villanueva,15 and Bsat16 placed balloon and open-tipped catheters outside the amniotic membranes with variable results. Their studies showed that frequency and relative intensity information of uterine contractions can be monitored outside the membranes similar to external tocodynamometry. Studies have shown that this information may even be sufficient for pitocin augmentation and induct ion.17 However, resting tone and absolute pressure information is not available with extraovular placed catheters. In addition, intrauterine catheters available commercially have not been developed to work outside of the amniotic cavity. It is noted in the above studies that potential safety issues of perforation, abruption, amnionitis, etc., exist with any internal uterine monitoring whether the catheter is intraovular or extraovular. However, the clinician must know where the intrauterine catheter tip resides if he or she is to amnioinfuse. Meconium staining, abnormal FHR due to cord compression, and infection will not be ameliorated by amnioinfusing outside the membranes. Furthermore, complications of placental abruption, amniotic fluid embolism,18-19 uterine rupture, and perforation may be more prone because the catheter is dissecting between tissues layers.

From this study it is now known that upon first insertion, at least 14% and as high as 38% of intrauterine catheters are placed outside the amniotic membranes. This is an alarming fact in view of the potential poor waveforms and adverse complications which may result if the clinician is unaware of the catheter location. Placement technique is important when inserting intrauterine pressure catheters. Careful attention to directing the catheter into the membrane slit or opening created by the amniotomy helps ensure amniotic space placement. However, it is often difficult to feel the membranes especially on high stations or retracted membranes. Withdrawing and redirecting the catheter during insertion until amniotic fluid flows through the catheter lumen increases the chances of placement into the amniotic space as pointed out by this study and as earlier suggested by Trudinger.4 Visualization of amniotic fluid upon insertion verifies placement. Frank blood return suggests extraovular placement and intrauterine pressure catheter withdrawal is recommended.

As referenced above, adverse effects such as placental perforation, placental abruption, artifactual waveforms, fetal heart rate tracing abnormalities, and dangerous and/or ineffective amnioinfusion problems can occur with improper placement (see Figure 2). It is also possible that fluid embolism as reported in the literature can be caused by amnioinfusing into the extraovular space.18 Abnormal FHR with extraovular placement

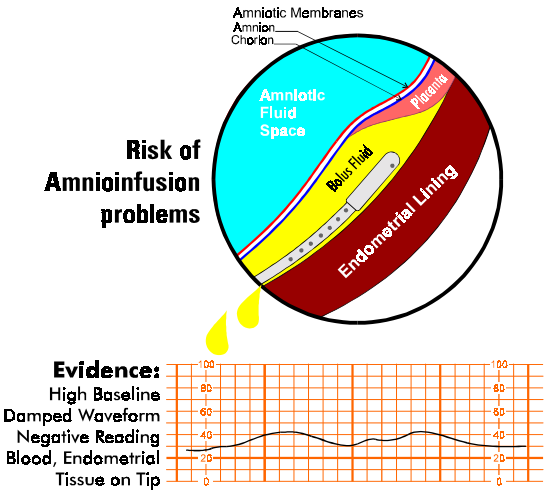

Figure 2. Potential placental abruption in extraovular placement with amnioinfusion.

may be caused by irritation between the chorion and decidua or by the catheter tip being in the vicinity of placental attachment. In these situations quick removal of the catheter is advised which usually eliminates the abnormal FHR.

Extraovular placements occur at a higher rate than most clinicians suspect. Any intrauterine pressure catheter can be placed outside the membranes, without the operator's recognition, even in the most experienced hands. When amniotic fluid flashback in the catheter lumen is visualized during catheter insertion, placement in the amniotic space is assured, amniotic fluid pressure readings are property monitored, and amnioinfusion will deliver fluid into the intended amniotic space, thus reducing potential complications. Additional studies involving larger numbers of intrauterine catheters, multiple sites, and multiple clinicians inserting catheters are needed to confirm the results of this study and to document the complications observed.

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