Studies on induced labor
Bakker, J.J.H.

Citation for published version (APA):

General rights
It is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), other than for strictly personal, individual use, unless the work is under an open content license (like Creative Commons).

Disclaimer/Complaints regulations
If you believe that digital publication of certain material infringes any of your rights or (privacy) interests, please let the Library know, stating your reasons. In case of a legitimate complaint, the Library will make the material inaccessible and/or remove it from the website. Please Ask the Library: http://uba.uva.nl/en/contact, or a letter to: Library of the University of Amsterdam, Secretariat, Singel 425, 1012 WP Amsterdam, The Netherlands. You will be contacted as soon as possible.
Does use of an intrauterine catheter during labor increase risk of infection?

Karlijn van Halem
Jannet J. H. Bakker
Corine J. Verhoeven
Dimitri N. M. Papatsonis
Elisabeth D. van Oudgaarden
Petra F. Janssen
Kitty W. Bloemenkamp
Ben Willem J. Mol
Joris A. M. van der Post

Published in the Journal of Maternal and Fetal Neonatal Medicine
2012 Apr;25(4):415-8
ABSTRACT

Objective To determine whether the use of an intrauterine catheter during labor is related to the occurrence of infection in mother or newborn during labor and up to 3 weeks postpartum.

Methods We performed a follow-up study of 1435 women who participated in a previously published multicentre randomized controlled trial in the Netherlands that assigned women in whom labor was induced or augmented with intravenous oxytocin to internal or external tocodynamometry. In the present post hoc analysis, we assessed the risk for infection, defined as a composite measure of any clinical sign of infection, treatment with antibiotics or sepsis during labor or in the postpartum period up to 3 weeks in mother or newborn.

Results There were 64 cases with indication of infection in the intrauterine catheter group (8.8%) versus 74 cases in the external monitoring group (10.4%). Relative risk: 0.91, 95% confidence interval: 0.77–1.1, and p: 0.33.

Conclusion Use of an intrauterine catheter during labor does not increase the risk of infection.
INTRODUCTION

Intrauterine catheters are frequently used for intrapartum monitoring of uterine activity, especially when labor is induced or augmented. The American College of Obstetricians and Gynecologists (ACOG) and the Society of Obstetricians and Gynecologists of Canada (SOGC) advise the use of internal tocodynamometry (IT) in selected circumstances, such as when the mother is obese, when one-on-one nursing care is not available, or when the response to oxytocin is limited. 1;2

Intrauterine catheters are also used for amnioinfusion. Amnioinfusion is thought to reduce the risk of meconium aspiration and may possibly reduce fetal heart rate abnormalities and reduce caesarean sections rates. 3

Known risks of using an intrauterine pressure catheter are twofold: first, infrequent but potentially serious complications associated with insertion of the catheter-like placental or fetal vessel damage or anaphylactic shock. 4-10 The frequency of these risks is estimated to be between 1:300 and 1:1400.9;11 Second, use of an intrauterine pressure catheter is also thought to be associated with increased risk of infection during labor and in the postpartum period.4;7;12;13 Thoulon et al. found a nearly threefold increased risk of endometritis in the IT group [relative risk (RR): 2.8 and 95% confidence interval (CI): 1.4–5.8]. Gibbs et al., however, found no increase in frequency or severity of infection in patients who underwent a caesarean section after internal monitoring.14;15

Because all data collection in these previous studies were in a retrospective manner, the issue to be answered still remains whether use of an intrauterine catheter during labor is related to the occurrence of infection in mother or newborn during labor and up to 3 weeks postpartum.

METHODS

Study design

The present study was a follow-up of a previously published multicentre randomized controlled trial performed in the Netherlands between May 2004 and November 2007, registered as International Standard Clinical Trial (ISRCTN 13667534, NTR 285). 16

The study protocol was approved by the medical ethical committee of the Máxima Medical Centre in Veldhoven, the Netherlands, and approval was obtained from the local committees of the other hospitals.

In the parent trial, women were randomized to either placement of an intrauterine pressure catheter or management by external measurement of contractions. In the women assigned to external monitoring, uterine activity was monitored with external tocodynamometry (Hewlett-Packard, Philips Medical Systems). The study protocol allowed cross over to internal monitoring in case progression of labor was insufficient and caesarean section was
being considered or in case infusion of fluid into the amnion for intrapartum management of meconium-stained amniotic fluid was indicated. In women allocated to the IT group, a Koala, sensortipped catheter system as intrauterine pressure catheter (Clinical Innovations, Inc., Murray, Utah), was entered at the first vaginal examination after randomization.

A follow-up study was done to assess whether women or their newborns were at risk for infection up to 3 weeks postpartum. We included from the data-set of the parent trial women >36 weeks of gestational age with a singleton pregnancy, a child in vertex position and an indication for intravenous oxytocin to stimulate contractions during labor. Women with an indication for prophylactic antibiotic during labor for known positive GBS status, heart disease, or other reasons for prophylaxis were excluded. So were women with a history of caesarean section, signs of intrauterine infection, intrauterine fetal death, or fetal distress prior to study entry, and women with a positive hepatitis B or HIV serology were excluded. The rates during labor were extracted from the database of the parent trial.

For the data until 3 weeks postpartum, all medical files of the women were searched for maternal or neonatal indication of infection. The researcher was unaware whether an intrauterine catheter was used during labor.

Study endpoints

Indication of infection was defined as a composite measure for every sign or treatment of maternal or neonatal infection during labor up to 3 weeks postpartum. Secondary endpoints were sepsis (defined as at least one positive blood culture in mother or newborn), therapeutic treatment with antibiotics of mother or newborn, and clinical signs of infection (defined as C-reactive protein above 20 mg/l or leucocytes above 15 x103/μl or temperature above 37.8 C or below 36C in addition for newborns at any time).

Statistical analysis

Analysis was performed with the statistical data management package of SPSS, version 14.0.2, for Windows 2000 (Microsoft). For continuous variables, we used analysis of variance in normal distributions and the Mann–Whitney U test otherwise. For categorical items, we used Fisher’s exact test. The p value for all hypothesis tests was two sided and p values of 0.05 or less were considered to indicate statistical significant differences. Analysis was initially done according to intention to treat. In a subsequent per protocol analysis, women were analyzed according to the actual treatment given. Women independent of their allocation, who had an intrauterine catheter inserted for monitoring contractions or for amnioinfusion to washout meconium-stained amniotic fluid, were assigned to the intervention group.

The control group contained women who did not receive an intrauterine catheter. Again, we calculated a relative risk for the occurrence of infection. As the groups in the per protocol analysis might have different baseline characteristics, we performed a multivariable logistic regression analysis to adjust for potential confounders.
RESULTS

Patients
We included 1435 women, of which 726 women were allocated to the IT group and 709 women to the external monitoring (ET) group. In the IT group, 31 women did not receive an intrauterine pressure catheter, either because the catheter could not be inserted or because labor went very fast. In the ET group, 51 women had an intrauterine catheter placed for amnioinfusion, 86 women received an intrauterine pressure catheter because of clinical judgment of inadequate labor monitoring and insufficient progression. We performed a complete search of the 1435 clinical patient files.

Intention to treat analysis
In the intention to treat analysis, the women were analyzed according to their allocation. The baseline characteristics of the randomized study groups were comparable (Table 1). The composite endpoint, indication of infection (every sign or treatment of maternal or neonatal infection during labor up to 3 weeks postpartum) did not differ statistically significant between the groups [IT group: 64 (8.8%), ET group: 74 (10.4%), RR: 0.91, 95% CI: 0.77–1.1, and p: 0.33]. In a subgroup of women with meconium-stained liquid, the risk for infection was also comparable between the study groups (11.4% in the IT group versus 11.9% in the ET group, RR: 0.96, 95% CI: 0.53–1.7, and p: 0.88). Secondary endpoints were also not statistically different between study groups (Table II).

Table 1. Baseline characteristics

<table>
<thead>
<tr>
<th>Intention to treat characteristics</th>
<th>IT group (n 726)</th>
<th>ET group (n 709)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primiparae</td>
<td>461 (63.5%)</td>
<td>452 (63.8%)</td>
<td>ns</td>
</tr>
<tr>
<td>Induction</td>
<td>474 (65.3%)</td>
<td>436 (65.3%)</td>
<td>ns</td>
</tr>
<tr>
<td>Augmentation</td>
<td>252 (34.7%)</td>
<td>246 (34.7%)</td>
<td>ns</td>
</tr>
<tr>
<td>Vaginal instrumental delivery</td>
<td>230 (31.7%)</td>
<td>214 (30.2%)</td>
<td>ns</td>
</tr>
<tr>
<td>Caesarean section</td>
<td>120 (16.9%)</td>
<td>113 (15.9%)</td>
<td>ns</td>
</tr>
<tr>
<td>Per protocol intervention (n 832)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primiparae</td>
<td>554 (66.6%)</td>
<td>359 (59.5%)</td>
<td>0.006</td>
</tr>
<tr>
<td>Induction</td>
<td>557 (66.9%)</td>
<td>380 (63.0%)</td>
<td>ns</td>
</tr>
<tr>
<td>Induction for &gt;24 hour PROM*</td>
<td>79 (9.5%)</td>
<td>60 (10%)</td>
<td>ns</td>
</tr>
<tr>
<td>Augmentation</td>
<td>275 (33.1%)</td>
<td>223 (37.0%)</td>
<td>ns</td>
</tr>
<tr>
<td>Amnioinfusion</td>
<td>108 (13.0%)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Ten or more vaginal examinations</td>
<td>51 (6.1%)</td>
<td>14 (2.3%)</td>
<td>0.001</td>
</tr>
<tr>
<td>Mean duration of labor, hrs:min (SD)</td>
<td>5:58 (4:08)</td>
<td>5:26 (4:08)</td>
<td>0.018</td>
</tr>
<tr>
<td>Caesarean section</td>
<td>153 (18.4%)</td>
<td>80 (13.3%)</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Data are presented with numbers and percentages unless stated otherwise (n,%). *PROM is an abbreviation for prelabor ruptured of membranes.
Per protocol analysis

In the per protocol analysis, we compared 832 women who actually had an intrauterine catheter inserted during labor and 603 women who did not (Figure 1). There were statistically significant differences between the baseline characteristics of the study groups as the rates of primiparae, caesarean sections, number of vaginal examinations, and women with longer

![Flowchart Image]

**Fig 1. Flowchart**

**Table 2A. Outcomes intention to treat**

<table>
<thead>
<tr>
<th></th>
<th>IT group (n 726)</th>
<th>ET group (n 709)</th>
<th>RR</th>
<th>95% CI</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary outcome*</td>
<td>64 (8.8%)</td>
<td>74 (10.4%)</td>
<td>0.91</td>
<td>0.77 to 1.1</td>
<td>0.33</td>
</tr>
<tr>
<td>Maternal Outcome (n, %)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sepsis**</td>
<td>2 (0.3%)</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signs of infection</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- C-reactive protein ≥20</td>
<td>13 (1.8%)</td>
<td>9 (1.3%)</td>
<td>1.2</td>
<td>0.73 to 2.0</td>
<td>0.52</td>
</tr>
<tr>
<td>- Leucocytes ≥15</td>
<td>15 (2.1%)</td>
<td>16 (2.3%)</td>
<td>0.96</td>
<td>0.68 to 1.4</td>
<td>0.86</td>
</tr>
<tr>
<td>- Temperature ≥ 37.8</td>
<td>18 (2.5%)</td>
<td>11 (1.6%)</td>
<td>1.3</td>
<td>0.82 to 2.1</td>
<td>0.26</td>
</tr>
<tr>
<td>Use of antibiotics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- during labor</td>
<td>29 (4.0%)</td>
<td>43 (6.1%)</td>
<td>0.79</td>
<td>0.59 to 1.1</td>
<td>0.09</td>
</tr>
<tr>
<td>- postpartum</td>
<td>24 (3.3%)</td>
<td>25 (3.5%)</td>
<td>1.0</td>
<td>0.66 to 1.6</td>
<td>1.0</td>
</tr>
<tr>
<td>Neonatal Outcome (n, %)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sepsis**</td>
<td>1 (2.3%)</td>
<td>1 (1.9%)</td>
<td>1.2</td>
<td>0.1 to 18.4</td>
<td>1.0</td>
</tr>
<tr>
<td>Signs of infection</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- C-reactive protein ≥20</td>
<td>9 (1.2%)</td>
<td>9 (1.3%)</td>
<td>0.98</td>
<td>0.39 to 2.5</td>
<td>1.0</td>
</tr>
<tr>
<td>- Leucocytes ≥15</td>
<td>30 (4.1%)</td>
<td>35 (5.0%)</td>
<td>0.83</td>
<td>0.52 to 1.4</td>
<td>0.53</td>
</tr>
<tr>
<td>- Temperature ≥ 37.8 or ≤ 36.0</td>
<td>10 (1.4%)</td>
<td>13 (1.8%)</td>
<td>0.75</td>
<td>0.33 to 1.7</td>
<td>0.53</td>
</tr>
<tr>
<td>Use of antibiotics</td>
<td>40 (5.5%)</td>
<td>46 (6.5%)</td>
<td>0.86</td>
<td>0.33 to 2.1</td>
<td>0.83</td>
</tr>
</tbody>
</table>

* The primary outcome was an aggregated variable including every sign or treatment of maternal or neonatal infection during labour up to three weeks postpartum. ** Sepsis was defined as at least one positive blood culture.
duration of labor were higher in the intrauterine catheter group (Table I). The composite endpoint, indication of infection, was again not statistically different between study groups (adjusted OR: 0.99, 95% CI: 0.85–1.1, and p: 0.86) as were the secondary endpoints (Table III).

Comment

In this study, we found no indication that the actual use of an intrauterine catheter increases risk for late-onset infection for mother or newborn in the postpartum period of 3 weeks. The parent trial already reported no differences in infection rates during labor. An accurate diagnosis of infection is difficult because women and newborns will be treated with antibiotics as soon as the suspicion of infection rises. Therefore, we analyzed our data for three different endpoints representing the whole spectrum of clinical definitions of infection, proven infection, and clinical signs of infection. For complete infection rate estimation, we also included the already published intrapartum rates for infection in our composite endpoint. Meconium-stained liquid is known to be associated with a higher prevalence for maternal and neonatal infection.17
We did not exclude these women because there was no confounding and no imbalance between study groups.

The limitation of our study is that we did not assemble routine cultures from mother, child, or placenta. It is possible that differences in bacterial cultures would have been found. It is possible that cases of infection were missed as women may have consulted other health care providers in their postpartum period, which was not recorded in their medical file. Therefore, we contacted over half of the women in our trial by telephone and mail; we did not find additional cases of neonatal or maternal infection. We therefore expect that the number of infections that were missed will be negligible.

We reported our outcomes both as intention to treat as per protocol, i.e., according to the actual treatment given, because we wanted to determine whether insertion of an intrauterine catheter itself increases risk for infection. In the per protocol analysis, statistically significant differences between the study groups in baseline characteristics include more primiparae, more vaginal examinations, longer duration of labor, and more caesarean sections in the intervention group.

In the parent trial, use of intrauterine tocodynamometry was allowed in the ET group in case of insufficient progression of labor; therefore, the intervention group comprises more women with a prolonged complicated labor. For this per protocol analysis, outcomes were adjusted for confounders, duration of labor, and caesarean section.

The findings of this study are in contrast with the higher risk for infection found by Thoulon et al. Their study is a nonrandomized study that compares a period with IT with a historic cohort where external tocodynamometry was used.17

Furthermore, internal monitoring was mainly used for deliveries with increased risks and their outcomes were not adjusted for confounding and focused on the maternal infections alone.

We found no indication that use of an intrauterine catheter for monitoring contractions or for amnioinfusion increases the risk of infection during labor or in the postpartum period up to 3 weeks in mother or newborn.

Declaration of interest: The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.
Intrauterine catheters and risk for infection

Chapter 5

REFERENCE LIST


(5) Harbison L, Bell L. Anaphylactoid Syndrome After Intrauterine Pressure Catheter Placement. 115, 407-408. 2010. Ref Type: Generic


