Original Article

Hospital versus outpatient care for preterm pre-labour rupture of membranes

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Background: To report the outcomes of women admitted following preterm pre-labour rupture of membranes (pPROM) and to determine whether the location of care (hospital vs outpatient) influences maternal and perinatal outcomes.

Methods: A retrospective cohort study was performed using routinely collected de-identified data of 144 women (between June 2007 and June 2011) who presented to the Mater Mother’s Hospital, Brisbane, Australia, with pPROM (prior to 34 weeks 0 days gestation) and who remained undelivered after 72 h from the time of ruptured membranes. Outcomes were compared for women who were subsequently managed as an outpatient (n = 53) versus those who were managed in hospital (n = 91). The two primary outcome measures were composite outcomes of (i) maternal morbidity and (ii) perinatal morbidity/mortality. The composite outcome of maternal morbidity comprised one or more of antepartum haemorrhage, clinical chorioamnionitis and/or endometritis, cord prolapse, blood transfusion, wound infection/haematoma/dehiscence/seroma. The composite outcome of perinatal morbidity/mortality comprised one or more of stillbirth, neonatal death, respiratory distress syndrome, neonatal infection, chronic neonatal lung disease, intraventricular haemorrhage, periventricular leukomalacia and necrotising enterocolitis.

Results: When adjusted for confounders, there was no difference between hospital care and outpatient care in the composite outcome measure of perinatal morbidity/mortality (aOR 1.37; 95%CI 0.55 – 3.47) or the composite outcome measure of maternal morbidity (aOR 1.62; 95%CI 0.67 – 3.89).

Conclusions: Women with pPROM who remain undelivered after 72 h and are managed out of hospital do not appear to have significant differences in major adverse maternal or perinatal outcomes compared with those managed as inpatients.

Keywords: ambulatory care, chorioamnionitis, fetal membranes premature rupture, pregnancy outcome, retrospective studies.

Background

Preterm pre-labour rupture of membranes (pPROM) occurs in 3% of pregnancies and is responsible for approximately one-third of all preterm births.1 While a number of factors increase the risk of pPROM, it often occurs in the absence of any known risk factors.2-3 The mechanisms leading to pPROM are poorly understood, but 25–50% of women with pPROM will have infection at the time of presentation.4 It is estimated that half of women with pPROM will go into labour within a week, and 75% within a fortnight.5

Preterm delivery is the major cause of perinatal morbidity and mortality associated with pPROM, and the perinatal morbidity and mortality largely depend on gestational age.6 The related morbidities associated with prematurity include respiratory distress syndrome (RDS), intraventricular haemorrhage (IVH), periventricular leukomalacia (PVL), necrotising enterocolitis (NEC), prolonged stay in the neonatal intensive care unit (NICU), difficulty with thermoregulation, difficulty with breastfeeding, as well as cerebral palsy and neonatal infection.7 Pregnancies complicated by pPROM are also at risk of cord prolapse,8 cord compression9 and placental abruption,10 and mothers are at increased risk of antenatal and postpartum infection.11

Management of pPROM varies significantly depending on the health care setting, local guidelines and protocols and the opinion of individual clinicians.12,13 and many hospitals have no agreed strategy. In a survey of U.S. obstetric units, less than one-third reported having formal management protocols.14 Some maternity services offer expectant management following pPROM as an outpatient. Women considered suitable include those living...
within an acceptable travelling distance of the hospital and with access to reliable transportation. Planned outpatient care is usually initiated after a period of monitoring in hospital with administration of corticosteroids and antibiotics, and in the absence of contractions, antepartum haemorrhage and/or infection. The advantages of outpatient care may include greater convenience for women and their families, reduced risk of thromboembolic disease and reduced costs for healthcare providers. Set against this are the disadvantages of being distant to facilities for delivery or emergency care. In addition, hospital care has often been considered necessary to enforce bed rest, which (despite a lack of evidence to support its efficacy) has formed part of management of pPROM. However, there is also no evidence to suggest that women at home who are advised to rest are less likely to comply.

Following an initial period of time in hospital, there is little evidence to guide clinicians and women as to the most appropriate environment for ongoing care. The Cochrane review on outpatient versus hospital care following pPROM includes two trials with a total of 116 women. It concluded that outpatient care is associated with fewer days in hospital and less cost but was unable to reach meaningful conclusions with respect to the likelihood of maternal and neonatal outcomes. Both the American College and Royal College statements on pPROM echo the lack of data to guide recommendations regarding hospital or outpatient care.

The study aims to report the outcomes of women admitted following pPROM prior to 34 + 0 weeks gestation and not delivered within the first 72 h and to determine whether the location of care (hospital vs outpatient) influences maternal and perinatal outcomes.

Materials and Methods
A retrospective cohort study was performed using routinely collected de-identified data from the Mater Mothers’ Hospital (MMH) electronic maternity database, MatriX (Meridian Health Informatics, Surry Hills, New South Wales, Australia). Consent from women whose records were included in this study was not sought. The Mater Health Services Human Research Ethics Committee reviewed the study and deemed it to meet the requirements for low/negligible risk research (Reference Number: 1833QA).

The data set included all 478 women who presented to the Mater Mother’s Hospital, Brisbane, Australia, with pPROM (prior to 34 weeks 0 days gestation), between June 2007 and June 2011. Of these, 151 women remained undelivered after 72 h from the time of ruptured membranes. Cases were excluded (n = 7) where the baby had a significant chromosomal or morphological abnormality. Records with incomplete information for the variables under investigation were included in the bivariate analysis, but were excluded from the multivariate analysis. The final cohort included 144 women.

Preterm premature rupture of membranes pPROM was diagnosed using a sterile speculum examination, requiring the visualisation of amniotic fluid in the posterior vaginal fornix. Digital vaginal examinations were not performed. All women with pPROM were managed according to hospital policy including administration of corticosteroids (two intramuscular injections of 11.4 mg betamethasone), concomitant use of oral nifedipine (20 mg QID, until 12 h following completion of corticosteroids) and a 10-day course of oral erythromycin. Delivery was indicated if there was a clinical diagnosis of chorioamnionitis and/or gestational age ≥ 37 weeks 0 days.

Women were considered suitable for outpatient care if there were no uterine contractions and there was no clinical suspicion of infection. The decision for outpatient care versus hospital care was at the discretion of the individual Specialist. Outpatient care comprised twice weekly review of symptoms, abdominal palpation, vital observations, fetal heart rate, assessment of amniotic fluid, and ultrasound scans for fetal growth (fortnightly), maternal full blood count and C-reactive protein (twice weekly). Hospital care comprised daily review of symptoms, abdominal palpation, vital observations, fetal heart rate, assessment of amniotic fluid, and ultrasound scans for fetal growth (fortnightly), maternal full blood count and C-reactive protein (twice weekly).

Outcomes were compared for women who were subsequently managed as an outpatient versus those who were managed in hospital. The two a priori primary outcome measures were composite outcomes of a) maternal morbidity and b) perinatal morbidity/mortality. The composite outcome of maternal morbidity comprised one or more of the following: antepartum haemorrhage, clinical chorioamnionitis and/or endometritis, cord prolapse, blood transfusion, wound infection/infection/hematoma/dehiscence/seroma. The composite outcome of perinatal morbidity/mortality comprised one or more of the following: stillbirth, neonatal death, RDS, neonatal infection, chronic neonatal lung disease, IVH, PVL and NEC. The individual outcomes contained in the composite perinatal outcome measure are reported as secondary outcomes in Table 2. The individual outcomes contained in the composite maternal outcome measure are reported as secondary outcomes in Table 3.

Bivariate analysis comparing demographic characteristics and outcomes across the two study groups was initially undertaken to identify potential confounders for inclusion in the multivariate analysis. Proportional data were compared using the χ² and Fisher’s exact test, and continuous data were compared using Student’s t-test. Unadjusted odds ratios (ORs) and 95% confidence intervals (CIs) are presented for the outcome measures. To determine whether there was a difference in the rate of maternal morbidity and/or perinatal morbidity/mortality between the hospital care and outpatient care groups, a multivariate logistic regression analysis was conducted. All 144 records were available for this analysis. In addition to the composite outcomes of maternal morbidity and perinatal morbidity/mortality
Table 1 Clinical characteristics of women with preterm pre-labour rupture of membranes (pPROM) receiving hospital care and outpatient care

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Hospital care n = 91</th>
<th>Outpatient care n = 53</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal age</td>
<td>30.8 (5.8)</td>
<td>29.0 (5.4)</td>
<td>0.066</td>
</tr>
<tr>
<td>Body Mass Index (kg/m²)</td>
<td>24.6 (5.3)</td>
<td>28.9 (11.6)</td>
<td>0.006*</td>
</tr>
<tr>
<td>Gestation at time of ruptured membranes (weeks)†</td>
<td>28.5 (26.3–31.3)</td>
<td>28.0 (24.0–31.7)</td>
<td>0.394</td>
</tr>
<tr>
<td>N (%)</td>
<td>N (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Publically funded</td>
<td>54 (59.3)</td>
<td>48 (90.8)</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>Privately funded</td>
<td>37 (40.7)</td>
<td>5 (9.4)</td>
<td></td>
</tr>
<tr>
<td>Nullipara</td>
<td>36 (39.6)</td>
<td>13 (24.5)</td>
<td>0.066</td>
</tr>
<tr>
<td>Multiple pregnancy</td>
<td>25 (27.5)</td>
<td>9 (17.0)</td>
<td>0.153</td>
</tr>
<tr>
<td>Use of artificial reproductive technology</td>
<td>24 (26.4)</td>
<td>2 (3.8)</td>
<td>0.001*</td>
</tr>
<tr>
<td>Diabetes and/or hypertensive disorder of pregnancy‡</td>
<td>12 (13.2)</td>
<td>11 (20.8)</td>
<td>0.232</td>
</tr>
<tr>
<td>Smoking at time of hospital booking</td>
<td>10 (11.0)</td>
<td>15 (28.3)</td>
<td>0.008*</td>
</tr>
<tr>
<td>Current or previous regular use of drugs and/or alcohol</td>
<td>14 (15.4)</td>
<td>15 (28.3)</td>
<td>0.062</td>
</tr>
<tr>
<td>Malpresentation at time of ruptured membranes</td>
<td>5 (5.5)</td>
<td>1 (1.9)</td>
<td>0.296</td>
</tr>
</tbody>
</table>

*P < 0.05.
†Mean (interquartile range).
‡Includes type 1 diabetes, type 2 diabetes, gestational diabetes, chronic hypertension, gestational hypertension and pre-eclampsia.

Results

Data were available for 144 women who gave birth at Mater Health Services, Brisbane following pPROM (prior to 34 weeks 0 days gestation) and where the time from ruptured membranes to birth was more than 72 h. Of these, 91 women were managed in hospital and 53 women were managed as an outpatient. Compared to women receiving ongoing hospital care after pPROM, those receiving outpatient care were more likely to be overweight and to report smoking at the time of hospital booking and less likely to be privately funded or to have conceived using assisted reproductive technology. There were no differences in the groups with respect to maternal age, parity, plurality, ethnicity, need for interpreter, socioeconomic status (measured by Socio-Economic Index for Areas (SEIFA)), level of education achieved, diabetes and/or hypertensive disorders of pregnancy, the reporting of current or previous regular use of drugs and/or alcohol, the gestation at which the membranes ruptured or the fetal presentation. (Table 1).

Perinatal outcomes were similar for women receiving hospital care and outpatient care. Babies of women who received outpatient care delivered at a later gestation, had a longer latency period from ruptured membranes until birth, had a higher birthweight and spent fewer days in NICU. However, there were no differences in perinatal mortality or the incidences of neonatal infection, RDS, chronic neonatal lung disease, PVL, periventricular haemorrhage or NEC. (Table 2). Additionally, there was no difference in the likelihood of Apgar score less than seven at five minutes (17.1% vs 8.0%; P = 0.108), needing intubation during resuscitation (22.0% vs 20.8%; P = 0.863), requiring admission to NICU (86.8% vs 81.1%; P = 0.361), or in the mean number of hours of mechanical ventilation (25.1 vs 11.6 h; P = 0.329), number of hours of Continuous Positive Airway Pressure (CPAP) (243.7 vs 105.2 h; P = 0.125) or number of days requiring oxygen (12.7 vs 11.7 days; P = 0.922). When adjusted for confounders, there was no difference between...
hospital care and outpatient care in the composite outcome measure of perinatal morbidity/mortality (aOR 1.37; 95%CI 0.55–3.47; Table 4).

Maternal outcomes were also similar for women receiving hospital care and outpatient care. Women receiving outpatient care were more likely to have their labour induced; however, there was no difference in the mode of birth, postnatal length of stay, or incidences of antepartum haemorrhage, cord prolapse, peripartum blood transfusion, caesarean section wound complications or maternal infectious morbidity. (Table 3). When adjusted for confounders, there was no difference between hospital care and outpatient care in the composite outcome measure of maternal morbidity (aOR 1.62; 95%CI 0.67–3.89; Table 4).

**Discussion**

For women with pPROM (prior to 34 weeks 0 days gestation), approximately two-thirds will deliver within...
‡Prolapse, blood transfusion and wound infection/haematoma/dehiscence.
†Chronic neonatal lung disease, periventricular haemorrhage, periventricular leukomalacia and necrotising enterocolitis.
*Composite outcome measure comprising one or more of stillbirth, neonatal death, respiratory distress syndrome, neonatal infection, chronic neonatal lung disease, perinatal mortality, and/or perinatal mortality.
‡Adjusted for gestation at birth, parity, plurality, fetal presentation and current or previous regular use of drugs and/or alcohol.

Table 4 Hospital care and outpatient care and their effect on maternal and perinatal outcome (multivariate stepwise logistic regression analysis adjusting for confounders)

<table>
<thead>
<tr>
<th>Composite outcome measure</th>
<th>Hospital care n = 91</th>
<th>Outpatient care n = 53</th>
<th>OR (CI)</th>
<th>Unadj P</th>
<th>aOR (CI)‡</th>
<th>Adj P‡</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perinatal morbidity/mortality*</td>
<td>62 (68.1)</td>
<td>30 (56.6)</td>
<td>1.64 (0.81–3.329)</td>
<td>0.166</td>
<td>1.37 (0.55–3.47)</td>
<td>0.501</td>
</tr>
<tr>
<td>Maternal morbidity†</td>
<td>21 (23.1)</td>
<td>14 (26.4)</td>
<td>0.84 (0.38–1.83)</td>
<td>0.653</td>
<td>1.62 (0.67–3.89)</td>
<td>0.280</td>
</tr>
</tbody>
</table>

72 h. Of those who remain undelivered after 72 h, the data suggest there is no difference in adverse maternal and perinatal outcomes for those receiving hospital and outpatient care. Whilst birth following pPROM is associated with morbidity for mother and baby, the data do not support that prolonged hospitalisation is associated with a reduction in this risk.

Women receiving hospital care were more likely to give birth to babies of a lower birthweight who spent more days in NICU; however, these differences were no longer apparent when the data were controlled for gestational age. It is not immediately apparent why those receiving hospital care were delivered at an earlier gestation (almost 2 weeks earlier than those managed as an outpatient). Privately funded women were over-represented in the cohort receiving hospital care. Whilst private models of care are often associated with increased intervention, we observed the incidences of induction of labour and elective caesarean section to be higher in the group managed as outpatients. This would not support the hypothesis that women were delivered earlier in the hospital care group because of increased intervention. However, it may imply that clinicians were more likely to recommend ongoing hospital care for certain women because they considered these women to be at higher risk of earlier delivery. It is also possible that there is some other factor associated with hospital care (potentially infection, psychological stress and immobility) that increases the likelihood of earlier delivery following pPROM in this group.

The Cochrane Review of home versus hospital management for pPROM includes two randomised controlled trials. Carlan reported on the outcomes of 55 women who were randomised to hospital or outpatient care 72 h after pPROM and included women with a singleton pregnancy, cervical dilatation <4 cm, amniotic fluid index >2 cm, no contractions, no evidence of infection and a cephalic presentation. Ryan reported on the outcomes of 61 women who were randomised to hospital or outpatient care 72 h after pPROM and included women with no cervical dilatation, no contractions, no evidence of infection, no meconium and living within 15 min of emergency care facilities. The review did not identify any differences in maternal or perinatal outcomes for women managed in home or in hospital; however, the authors recommended caution in applying the results of this review given the small numbers.

Our study of 141 pregnancies following pPROM is the largest cohort published, yet this remains a small study. The sensitivity analyses undertaken did not identify differences when data were stratified by plurality or fetal presentation, but numbers in these subgroups are too few to reliably conclude that outcomes would be similar for multiple pregnancies or nonvertex presentations. There are some data to suggest that nonvertex presentations in the setting of pPROM are associated with a higher incidence of cord prolapse. However, generally there are no clear guidelines as to whom outpatient care should be offered. If outpatient care is to be considered, it would seem reasonable for clinicians to consider adopting similar criteria to those of published studies that have reported equivalent outcomes for outpatient and hospital care: namely women with a latency period >72 h, singleton pregnancy, cephalic presentation, no evidence of infection, no contractions and residing in close proximity to appropriate obstetric and neonatal services.

Hospital care following pPROM is likely to be associated with more cost to the healthcare system. Prolonged hospitalisation must also have a financial and nonfinancial cost to the family unit in terms of lost earnings for woman and/or partner, removal of the primary carer for other children, social isolation and associated psychological stress. The stressors associated with prolonged antenatal hospitalisation are well described. However, home-based care is not always possible or appropriate. Future research should look to assess strategies to reduce these impacts.

This study has several limitations. This is an observational study, undertaken in a single centre and the criteria which clinicians used to recommend hospital care or outpatient care was not prescribed. The timing and mode of delivery following pPROM was also at the discretion of the treating clinician; however, similar hospital protocols are followed for women with pPROM receiving hospital care and outpatient care, and the indications for earlier delivery are the same in both
protocols. Data for the study were routinely collected and entered contemporaneously by midwives during a structured 90-min history visit and updated again following each hospital admission and the birth of the baby. The database is a comprehensive summary of clinical care and its outputs constitute the clinical record. This data are subject to entry error, and rarer clinical outcomes may be missed. However, there are hospital processes for reviewing and maintaining data quality, and contemporaneously entered data in prompted data fields are likely to be no less accurate than that derived from chart review. The groups of women managed as an outpatient and in hospital had risk factors, many of which have been controlled for. However, considering the low incidence of the outcomes being investigated, a stepwise regression model has been used, which is limited in its ability to control for all confounders. A randomised controlled trial would be the ideal study design to answer this clinical question.

In conclusion, where clinicians advise that women with pPROM who remain undelivered after 72 h can be managed as outpatients, the gestation is likely to be prolonged, the subsequent neonatal length of stay increased, and the likelihood of major adverse maternal or perinatal outcomes similar, compared with those who are managed in hospital.

References


