## Preterm pre-labour rupture of membranes (PPROM) MATY083

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_Hutt Maternity Policies provide guidance for the midwives and medical staff working in Hutt Maternity Services. Please discuss policies relevant to your care with your Lead Maternity Carer._

**Purpose:**

This guideline outlines the practice that relates to the management of preterm pre-labour spontaneous rupture of membranes (PPROM) at Hutt Hospital.

**Scope:**

For the purposes of this document, staff will refer to:

All staff within Hutt Valley DHB. This includes staff not working in direct contact with patients/consumers. Staff are taken to include anyone engaged in working to the Hutt Valley DHB. This may include but is not limited to:

- Employees irrespective of their length of service
- Agency workers
- Self-employed workers
- Volunteers
- Consultants
- Third party service providers, and any other individual or suppliers working in Hutt Maternity, including Lead Maternity Carers, personnel affiliated with third parties, contractors, temporary workers and volunteers
- Students

**Abbreviations and Definitions:**

Preterm pre-labour rupture of membranes, also referred to as PPROM, is the spontaneous rupture of membranes (SRM) prior to established labour, at a gestational age of less than 37+0 weeks.

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
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<tr>
<td>CTG</td>
<td>Cardiotocograph</td>
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<td>GBS</td>
<td>Group B Streptococcus</td>
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<tr>
<td>MEWS</td>
<td>Maternal early warning score</td>
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<tr>
<td>PPROM</td>
<td>Preterm pre-labour rupture of membranes</td>
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<tr>
<td>SRM</td>
<td>Spontaneous rupture of membranes</td>
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**Introduction**

Preterm pre-labour rupture of membranes (PPROM) is defined as rupture of the membranes prior to the onset of labour in women before 37+0 weeks of gestation.
It complicates 1-2% of all pregnancies, and is associated with 30-40% of preterm births (Bond 2017). Worldwide an estimated 15 million babies are born preterm, and the number is rising. Preterm birth complications are the leading cause of death globally among children under 5 years of age, responsible for approximately 1 million deaths in 2015 (WHO 2018). Even in developed countries such as the UK, preterm birth is still the single biggest cause of neonatal morbidity and mortality, affecting around 7.3% of live births in England and Wales in 2012 (NICE 2015). In New Zealand in 2015, approximately 77% of fetal deaths and 60% of infant deaths registered in 2015 were preterm, the majority of which were very preterm (< 28 weeks gestation) (MOH 2018).

There is evidence that women with clinically diagnosed PPROM who have reduced amniotic fluid volume on ultrasound are more likely to give birth within seven days from membranes rupture (Thomson 2019). The median latency from membrane rupture to birth is 8-10 days (median) from 24+0 to 28+0 weeks, decreasing to 5 days (median) at 31+0 weeks (Thomson 2019).

Guideline:

The clinical significance of PPROM varies with the gestational age and the time interval between the SRM and birth. PPROM are more likely to be triggered by underlying infection (RCOG, 2010). Prolonged SRM delivery intervals increase the risk of chorioamnionitis and perinatal morbidity and mortality. Optimal clinical management needs to factor into account the full clinical presentation, results of investigations and ongoing clinical developments. Gains in fetal maturity and / or hopes to avoid an intervention cascade following induction of labour, must be balanced with the need to avert significant perinatal sepsis.

Principles of Care for PPROM

- Establishing a diagnosis
- Exclude underlying infection or haemorrhage
- If PPROM associated with PV bleeding, vasa praevia must be considered (usually associated with CTG abnormalities and a low-lying placenta)
- Exclude malposition
- If cord prolapse suspected (consider a speculum or digital examination urgently)
- Management in accordance with gestational age

Associated Risks of PPROM

The risks associated with PPROM depend upon the gestation it occurs at, but may include:

- Preterm birth
- Cord prolapse
- Placental abruption
- Intrauterine infection / chorioamnionitis
- Neonatal prematurity complications: death, respiratory distress syndrome, chronic lung disease, intraventricular haemorrhage, necrotising enterocolitis, retinopathy
- Perinatal mortality
- Pulmonary hypoplasia and limb positioning defects (rare, associated ruptured membranes pre-viability)
Diagnosis, Assessment & Initial Investigations:

Diagnosis of spontaneous rupture of membranes is primarily based on history.

It is recommended that all women/pregnant people with term PROM should have a comprehensive assessment, to check maternal and fetal wellbeing.

- Confirm gestational age – review the dating method e.g. early versus late scan, or by LMP
- If PPROM associated with PV bleeding – *vasa prævia* must be considered (usually associated with CTG abnormalities and a low-lying placenta)
- Ascertain whether there is meconium-stained liquor (unlikely as preterm)
- Maternal temperature, pulse, blood pressure, respiratory rate and oxygen saturations (consider signs of intra-uterine infection / chorioamnionitis) and enter on MEWS
- General examination
- Palpate abdomen and uterus for tenderness and uterine activity
- Obvious SRM is where copious liquor is seen on woman/pregnant person themselves, their pads or clothing, and may not require a speculum examination
- If PPROM is not obvious then a sterile speculum is advisable to confirm membrane rupture
  - Perform examination after woman/pregnant person has rested for at least 30 minutes to allow any leakage of liquor to pool in posterior vaginal fornix
  - Look for liquor and/or appearances suggestive that vagina has been ‘washed out’ recently by fluid e.g. no discharge seen or vaginal walls are wet
  - If diagnosis is uncertain, *Amni®* (nitrazine pH indicator) or *AmniSure®* (placental alpha microglobulin-1 (PAMG-1)) testing may facilitate diagnosis
  - May need to admit for observation and pad checks every 4 hours
    - Bedside or formal ultrasound may be helpful in this situation (note – reduced liquor volume may be seen in the absence of PPROM and, conversely, a normal liquor volume may be seen, at least initially, in the presence of PPROM)
- Take a high vaginal swab. Suggest low vaginal/rectal (GBS) and high vaginal (PCR) swab for chlamydial / gonorrhoea swabs (if indicated)
- Avoid routine digital examination (unless cord prolapse is suspected)
- Mid-stream urine (MSU)
- Fetal monitoring
  - Admission CTG should be attempted from 23+0 weeks. CTG can be difficult to interpret or achieve less than 28 weeks, therefore in these cases intermittent auscultation with fetal doppler is acceptable.
  - Review of CTG interpretation should be in collaboration with Obstetric RMO/SMO
  - Discuss with an Obstetric SMO prior to CTG commencement for women less than 26+0 weeks.
- Bedside ultrasound if needed (by obstetric RMO or SMO) to assess presentation (increased chance of abnormal lie / malpresentation)
- Blood tests: FBC, CRP, Group & Hold
Obstetric Referral Guidelines (‘Section 88’) considerations

As per the Ministry of Health 2012 Obstetric Referral Guidelines:

<table>
<thead>
<tr>
<th>Code</th>
<th>Condition</th>
<th>Description</th>
<th>Referral category</th>
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<tbody>
<tr>
<td>4023</td>
<td>Preterm rupture of membranes</td>
<td>&lt; 37 weeks and not in labour</td>
<td>Consultation</td>
</tr>
<tr>
<td>4025</td>
<td>Premature labour</td>
<td>34+0 to 36+6 weeks</td>
<td>Consultation</td>
</tr>
<tr>
<td>4026</td>
<td></td>
<td>&lt; 34+0 weeks</td>
<td>Transfer</td>
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Ruptured Membranes not Confirmed

In the absence of observed liquor on speculum and a negative Amnicator® or Amnisure® test, it is reasonable to assume the membranes are intact.

If the history is suspicious but with negative clinical findings, then discharge the woman home with advice to:

- Carefully monitor vaginal discharge with pads over the next few days
- Liaise with LMC / Community Midwifery Team if any further concerns

Ruptured Membranes Confirmed

Follow guideline as seen in Appendix.

Predictors of Clinical Intrauterine Infection / Chorioamnionitis

Vaginal examinations (VEs) have been shown to be the strongest predictor of clinical chorioamnionitis for women/pregnant people with PROM, with increasing rates from three to four VEs (7-8 VEs versus 0-2, OR 2.37, p=0.04).5

![Exclamation] Vaginal examinations prior to labour and/or induction of labour are to be avoided unless indicated

Diagnosing Intrauterine Infection / Chorioamnionitis

Use a combination of clinical assessment and tests (WBC and/or CRP rise, CTG) to diagnose intrauterine infection / chorioamnionitis in women/pregnant people with PPROM.

The criteria for the diagnosis of clinical chorioamnionitis include:

- Maternal pyrexia
- Maternal tachycardia
- Uterine tenderness
- Offensive vaginal discharge
- Fetal tachycardia ± otherwise non-reassuring CTG
- Rising WCC or CRP (be aware that WCC can rise for 24 hours after steroids, for up to 3 days)

![Exclamation] When suspicion of chorioamnionitis, see Chorioamnionitis Antibiotic Guideline (MATY030)
Management of PPROM – Principles of Care:

**Steroids for fetal lung maturation**

All women/pregnant people under 35 week’s gestation (consider up to 35+6 weeks) should receive betamethasone (Celestone Chronodose®) for fetal lung maturation, primarily to reduce the risk of respiratory distress syndrome. (NICE 2019, Liggins Institute 2015, Roberts 2017)

**Dose:** 11.4mg IM (2 x 5.7mg ampoules), two doses of betamethasone approximately 24 hours apart

- If unavailable, use dexamethasone 6mg IM every 12 hours for 4 doses

Where there is a high-risk of delivery in less than 24 hours, administering the second dose 12 hours after the first is reasonable.

Antenatal steroids are most effective in reducing RDS in pregnancies that deliver 24 hours later and up to 7 days after administration of the second dose of antenatal steroids. Their use reduces neonatal death within the first 24 hours and, therefore, steroids should still be given even if delivery is expected within this time. (RCOG 2010)

**Nifedipine for tocolysis**

*See MATY072 Nifedipine Tocolysis Regime Policy*

Offer nifedipine for tocolysis to women/pregnant people under 35+0 weeks gestation who have both confirmed PPROM and uterine activity to facilitate the administration of betamethasone for fetal lung maturation, or at any gestation if transfer to another hospital is required e.g. due to a lack of SCBU beds at Hutt Hospital.

Tocolysis should continue for approximately 24 hours after the second dose of steroids and then stopped. There is no benefit from continuing after this, unless hospital transfer is being planned.

Care should be taken if nifedipine is being used in conjunction with magnesium sulphate, as both are calcium channel blockers and on rare occasions this can lead to ‘flash’ pulmonary oedema.

There is no evidence to support tocolysis if there is no uterine activity. Very low quality evidence suggests that nifedipine tocolysis reduced perinatal mortality, neonatal sepsis and intraventricular haemorrhage, whilst it is no better than placebo at delaying birth by more than 48 hours. (NICE 2015).

**Contra-indications to nifedipine tocolysis**

- Cardiac disease (myocardial infarction in previous seven days)
- Porphyria
- Severe hypotension

**Contra-indications to tocolysis**

- Gestational age ≥ 35+0 weeks
- Significant vaginal bleeding or suspected abruption
- Intrauterine infection / chorioamnionitis
- Fetal anomaly not compatible with life
- Maternal indication for birth exists e.g. eclampsia, pre-eclampsia
- Pathological fetal heart rate tracing
- Maternal decline of treatment

**Antibiotics**

Antibiotic prophylaxis for women/pregnant people with PPROM is associated with prolonged pregnancy and reduced maternal and neonatal infection. However, evidence that antibiotic prophylaxis in PPROM alters perinatal mortality or longer-term outcomes is lacking. The use of antibiotic prophylaxis in women/pregnant people with preterm labour in the absence of membrane rupture is not supported by the evidence.

There are two rationales for administering antibiotics in PPROM

- For GBS chemoprophylaxis due to the high risk of spontaneous preterm labour (a known risk factor for early onset GBS disease); and
- To prolong gestation (increase latency period).

Hutt Hospital recommends:

- Amoxicillin 2g IV q8h for 48 hours PLUS follow-up of Erythromycin 400mg PO QID for 10 days

**Allergy to penicillin:**

- **Allergy penicillin, without a history of anaphylaxis/angioedema**, consider:
  Cefazolin 2g IV q8h for 48 hours, PLUS follow-up of Erythromycin 400mg PO QID for 10 days
- **Significant allergy to penicillin or cephalosporins**, consider:
  Vancomycin 1g IV (infused over two hours) q12h for 48 hours, PLUS follow-up of Erythromycin 400mg PO QID for 10 days.

The choice of prophylactic antibiotics in PPROM will also depend on whether clinical signs of chorioamnionitis are present. Therapies may be modified based on the results of investigations. For patients with a hypersensitivity to penicillins, refer to the Therapeutic Guidelines or seek expert advice.

Co-amoxiclav (Augmentin™) should not be used as prophylaxis for intrauterine infection as it is associated with an increased risk of neonatal necrotising enterocolitis.

**Magnesium sulphate for fetal neuroprotection**

In women/pregnant people at risk of imminent early preterm (under 30+0 weeks gestation) birth, use magnesium sulphate for fetal neuroprotection, as per the Australasian 2010 guidelines (The Antenatal Magnesium Sulphate for Neuroprotection Guideline Development Panel 2010).

Magnesium sulphate should be given after liaising with on-call SMO at the receiving tertiary centre to which a woman/pregnant person will be transferred (usually Wellington Hospital):

- 4g IV loading dose, given slowly over 20-30 minutes
- 1g IV per hour maintenance dose

Continue regimen until birth or for 24 hours, whichever comes first.
Inpatient Management:

1. The woman/pregnant person should be admitted initially for approximately 48 hours (2 days) for observation (longer if indicated).
2. A care plan should be clearly documented in the clinical notes, and reviewed as necessary.
3. Complete the course of steroids, tocolysis and antibiotics (as appropriate).
4. Maternal temperature and pulse should be monitored every six hours whilst awake (approximately 0700h, 1200h, 1800h and 2300h), and documented on MEWS.
5. CTG should be performed twice a day.
6. These investigations can be performed more frequently if indicated.
7. Organise an in-patient growth scan with liquor volume and umbilical artery Doppler indices within a few days of admission.
8. The presence of any of the following should be a trigger to commence CTG monitoring and request obstetric review:
   - Regular abdominal pains or tenderness
   - Change in the colour of liquor
   - Vaginal bleeding
   - Reduced fetal movements
9. A high-index of suspicion for possible intrauterine infection / chorioamnionitis should be considered at all times.

If chorioamnionitis is suspected, urgent Obstetric RMO review should be requested, and discussed with the Obstetric SMO on-call ± Paediatric RMO / SMO on-call

Outpatient Management:

Women/pregnant people should be considered for outpatient monitoring of PPROM on an individual basis only after assessment and a documented plan by a consultant obstetrician. There is insufficient data to make recommendations for outpatient monitoring, rather than continued hospital admission, in people with PPROM.

It is therefore recommended for the woman/pregnant person to stay in hospital for at least 48 hours before discharge. If there are no signs of labour and all observations are satisfactory this time, the woman/person may be discharged home only after assessment by a Consultant Obstetrician.

Issues to consider when considering outpatient management include:

- Maternal preferences
- Gestational age
- Distance woman/pregnant person lives from hospital
- Support at home
- Transport access
Women/pregnant people should report to (LMC or birthing suite) immediately if any of the following signs and symptoms of chorioamnionitis are present, which include:

- Maternal pyrexia: from feeling unwell (hot/cold) AND/OR a temperature above 37.8°C
- Abdominal pain or regular contractions
- Changes to vaginal discharge (smell/colour)
- Reduced fetal movements

If any of the above signs and symptoms occur, if there are reduced fetal movements or the woman/person has any other concerns, they are advised to contact their Lead Maternity Carer (LMC) immediately.

Women/pregnant people should be advised to refrain from the use of tampons.

**Outpatient MAU plan**

An outpatient management plan should be documented, and copied to LMC and GP.

Recommend twice weekly review in Maternity Assessment Unit (MAU), including:

- Maternal temperature, pulse, BP, and CTG
- Weekly tests and investigations: FBC (be aware WCC can rise 24hrs post steroid, for up to three days), CRP and high vaginal swab
- Ultrasound assessment of liquor volume and umbilical Doppler PI (weekly) and growth (every two weeks)

It is recommended a combination of clinical assessment, maternal blood tests (CRP and WBC) and fetal heart rate (CTG) should be used to diagnose chorioamnionitis in women/pregnant people with PPROM; it is explicitly noted that these parameters should not be used in isolation for diagnosis.

**Management of PPROM – Gestational Considerations:**

Once rupture membranes are confirmed, the management will depend upon the gestation at which PPROM has occurred. Please refer to Appendix for flow diagram.

**Under 32 week’s gestation**

Women/pregnant people under 32 weeks require transfer to Wellington Regional Hospital (if appropriate), as Hutt Hospital does not accept neonates less than 32+0 weeks gestation (or estimated weight <1.5kg)

- Steroids for fetal lung maturation
- Nifedipine tocolysis (if indicated)
- Amoxicillin 2g IV q8h for 48 hours PLUS follow-up of Erythromycin 400mg PO QID for 10 days *(See alternate antibiotics section for penicillin allergy)*
- Magnesium sulphate for fetal neuroprotection (consider for less than 30+0 weeks gestation)
32+0 to 36+6 week’s gestation

- Steroids for fetal lung maturation until 34+6 (consider up to 35+6) weeks
- Nifedipine tocolysis (if indicated)
- Amoxicillin 2g IV q8h for 48 hours
  PLUS follow-up of Erythromycin 400mg PO QID for 10 days (See alternate antibiotics section for penicillin allergy)
- Admit to hospital for 2 days for observation, unless clinical indication for longer admission
- Then consider out-patient management
- Regular USS assessment of growth, liquor and Doppler as needed
- Bloods biweekly when managed as outpatient
- Consider antenatal Clexane for venous thromboembolism (VTE) prophylaxis if PPROM very early, due to reduce physical activity or if there are other VTE risk factors present
- Recommend delivery at 37+0 weeks, if not indicated earlier (i.e. GBS / chorioamnionitis)

Mode of Delivery

In the absence of fetal or maternal compromise or other obstetric factors necessitating a caesarean, planned vaginal birth is usually indicated.

Induction of Labour

If a woman/pregnant person has not either spontaneously laboured or needed delivery prior, recommend induction of labour (assuming baby is cephalic and no other contra-indications) at 37+0 weeks.

For women/people who are Group B Strep positive, consider induction from 34 weeks, following a course of steroids.

Elective Caesarean Birth

If elective caesarean birth is indicated, then arrange for 37 weeks gestation.

Explain to women/pregnant person that caesarean birth at preterm gestations, especially very early preterm, can be technically challenging. There is an increased likelihood of a vertical uterine incision and thus the consequent implications of this for future pregnancies (NICE 2015).

Information to Offer to Pregnant People:

- RCOG leaflet “When your waters break prematurely”
- NZ MFM Network PPROM (under 32 weeks)
- RANZCOG Group B Streptococcus

Related Documents:

- Chorioamnionitis Antibiotic Guideline MATY030
- Nifedipine Tocolysis Regime Policy MATY072
Reference:

- Thomson, AJ, on behalf of the Royal College of Obstetricians and Gynaecologists Green Top Guideline No. 73. *Care of Women Presenting with Suspected Preterm Prelabour Rupture of Membranes from 24^0 Weeks of Gestation*. *BJOG* 2019; 126: e152– 166

Keywords for searching:

1. Preterm pre-labour rupture of membranes
2. PPROM
3. MATY056
4. Steroids
5. Betamethasone
6. Pregnancy
7. Premature

Informed Consent:

The right of a consumer to make an informed choice and give informed consent, including the right to refuse medical treatment, is enshrined in law and in the Code of Health and Disability Consumers’ Rights in New Zealand. This means that a woman can choose to decline treatment, referral to another practitioner, or transfer of clinical responsibility. If this occurs follow the process map on page 18 of the Referral Guidelines (Ministry of Health, 2012).

Tangata Whenua Statement:

The Women’s Health Service recognises the rights and responsibilities of Māori as tangata whenua and Treaty Partners. This allows and acknowledges the importance of cultural diversity in all aspects of our care and practice in Aotearoa New Zealand.

As stated in *Te Pae Amorangi* (Hutt Valley DHB Māori Health Strategy) 2018-2027, Hutt DHB as a Crown agency is committed to our role in maintaining active relationships with iwi, under Te Tiriti o Waitangi. This strategy recognises the established principles of Partnership, Participation and Protection and recognises steps towards the reviewed interpretation of Te Tiriti principles to date (from the *Wai 2575* claim into health). These are tino rangatiratanga, equity, active protection, partnership and options.

Attention in particular is drawn to:

- **Article one – Kāwanatanga**: actively engaging and working alongside with local iwi through the Hutt Valley Māori Health Unit
- **Article two – Tino Rangatiratanga**: Self-autonomy, self-determination; the responsibility to enable Māori to exercise their authority over their own health, determinants and definition of health
• **Article three – Ōritetanga**: equal health outcomes of peoples; ensuring that policy, guidelines or programmes do not further perpetuate any inequity

• **Article four (the ‘oral clause’) – Wairuatanga**: spirituality; thriving as Māori and the importance of health providers understanding health in te ao Māori (the Māori world), acknowledging the interconnectedness and inter-relationship of all living and non-living things.
## Appendix 1: Suspected Preterm Pre-Labour Rupture of Membranes (PPROM)

Primary assessment: history, examination, speculum (Amnicator if uncertainty), CTG, maternal observations (temperature, pulse, blood pressure, respiratory rate, oxygen saturations), "GBS swab", Liquor – check for colour, presence of meconium or blood

### Confirmed PPROM
- Evidence of chorioamnionitis
- IV antibiotics & steroids
- Expedite birth

### No SCBU beds – organise transfer to tertiary centre – Wellington

#### ≤ 31+6 weeks
- Amoxicillin 2g IV q8h for 48 hours
- Betamethasone 11.4mg IM x 2 (24hrs apart)
- Consider magnesium sulphate if <30wk
- Nifedipine tocolysis
- PLUS follow-up of Erythromycin 400 mg PO QID for 10 days
- Transfer to tertiary centre – Wellington

#### 32+0 – 34+6 weeks
- Amoxicillin 2g IV q8h for 48 hours
- Betamethasone 11.4mg IM x 2 (24hrs apart)
- PLUS follow-up of Erythromycin 400 mg PO QID for 10 days
- Nifedipine tocolysis if contracting and not bleeding
  - Nifedipine quick acting 10mg PO Q15mins x4
  - Nifedipine SR PO TDS for 36-48 hours
  - 20mg TDS if stopped tightening
  - 40mg TDS if still tightening
  - 60mg TDS if tightening strongly

#### ≥ 35+0 weeks
- Expectant management
- Amoxicillin 2g IV q8h for 48 hours
- PLUS follow-up of Erythromycin 400 mg PO QID for 10 days

### Indications for Induction of Labour at any time
- Clinical concern regarding chorioamnionitis and/or fetal compromise
- Caesarean section indicated for obstetric indications
- GBS positive on MSU or swab and ≥ 34+0 weeks

### On-going Management
- Growth scans every 2-3 weeks
- Chase vaginal swabs & MSU – treat any infection
- In-patient for 3-4 days
- If stable & appropriate can then be an out-patient
- Review at least weekly through MAU

### Plan IOL at 37 weeks
- No
  - GBS positive at PPROM
  - Yes
    - Consider IOL from 34 weeks

### Penicillin allergy

<table>
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<tr>
<td>Cefazolin 2g IV q8h for 48 hours, PLUS follow-up of Erythromycin 400 mg PO QID for 10 days</td>
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</tbody>
</table>

| High-risk of anaphylaxis: immediate onset rash, anaphylaxis/angioedema, severe cutaneous reaction e.g. SR, DRESS, TENs | Yes |
|-----------------------------------------------------------------------------------------------------------------|
| Vancomycin 1g IV (infused over two hours) q12h for 48 hours, PLUS follow-up of Erythromycin 400 mg PO QID for 10 days |
Appendix 2 Steroids for women/pregnant people at risk of preterm labour

Woman/pregnant person at risk of preterm birth before 34+6 weeks gestation

Give one course of antenatal steroids (two doses of betamethasone as Celestone Chronodose® 11.4mg IM 24 hours apart – 12 hours if significant risk of birth within 24 hours)

Still at risk of preterm birth ≥7 days after initial dose of steroids AND ≥32+6 weeks

Single dose of betamethasone as Celestone Chronodose® 11.4mg IM

If 23+0 to 24+6 weeks, consider discussion with on-call Obstetric SMO at tertiary hospital prior to administration

If woman/pregnant person has diabetes, admit for blood sugar monitoring

Planned Caesarean birth up to 37+6 weeks with diabetes in pregnancy

Give one course of antenatal steroids (two doses of betamethasone as Celestone Chronodose® 11.4mg IM 24 hours apart)

Admit for blood sugar monitoring