Disclosure

Learning Objectives

- Understand the risk factors and mechanisms of preterm birth
- Evaluate clinical efficacy of diagnostic tools
- Discuss management strategies and interventions for preterm birth for improved outcomes
- Introduce the March of Dimes Preterm Labor Assessment Toolkit (PLAT) and discuss strategies to introduce PLAT into your organization
Preterm Birth is a Major Issue in Obstetrics

Incidence of Preterm Birth in US, 1 in 10 Infants

Preterm Births in the US (%)

2013 Preterm Birth by Gestational Week

- Preterm Births in the US (%)

- 2013 Preterm Birth by Gestational Week


March of Dimes Report Card
U.S. Premature Birth Rate – 9.6%


March of Dimes Premature Birth Report Card

March of Dimes Premature Birth Report Card

March of Dimes Premature Birth Report Card
Newborn Survival by Gestational Age


Complications of Preterm Birth

Early Consequences
- Mortality
  - 16-fold higher risk for infants born at 28-30 weeks, compared with term infant
- Morbidity
  - Respiratory, gastrointestinal, immunological and CNS complications
  - Significant economic and emotional costs

Long-Term Consequences
- Neuro-developmental disabilities
- Altered pulmonary function
- Metabolic and cardiovascular risk
- Decreased long-term survival and reproductive capabilities

The High Cost of Preterm Birth

The estimated annual societal economic cost of preterm birth in the U.S. was $26.2 billion, or more than $51,000 per premature infant.

Average first year medical cost, in 2005 dollars

Those 2005 costs show that the medical cost of a preterm birth is 10 times the cost of an uncomplicated term birth.
Preterm Birth as a Syndrome

Preterm labor as a syndrome associated with multiple mechanisms of disease

A cluster of problems with a set of overlapping factors

- Causes
- Mechanisms
- Risk Factors

Causes of Preterm Birth

- Inflammation/Infection
  - Chrono-decidual
  - Systemic

- Decidual Hemorrhage
  - Abruption

- Activation of Maternal/Fetal HPA Axis
  - Maternal/fetal stress

- Pathological Uterine Distension
  - Multifetal pregnancy
  - Polyhydramnios
  - Uterine abnormality

References:


Mechanisms of Preterm Birth

Causes of Preterm Birth

- Chorion/Decidual
- Fetal Fibronectin Leak
- Proteases
- Uterine Contractions
- Cervical Change
- PROM
- Uterotonins

Preterm Birth


Clinical Risk Factors: Spontaneous Preterm Birth

Clinical Factors

- Prior history of SPTB
- Multiple gestation
- Cervical insufficiency, uterine abnormalities
- Vaginal bleeding
- Anemia
- Low pre-pregnancy weight
- Infection

Demographics

- African American ethnicity
- Maternal age <17 and >35 years
- Low socioeconomic status
- Maternal stress
- Behavior patterns: Cigarette smoking, drug abuse


Clinical Risk Factors: Limited Sensitivity

Risk factors fail in both directions 1,2

- More than 1/2 of women who deliver preterm do not have identifiable risk factors
- Approximately 2/3 of women with traditional risk factors do not go on to deliver preterm


For Symptomatic Patients

Diagnosis of Preterm Labor

Diagnosis of Threatened Preterm Labor
Determining patients at greatest risk of preterm birth is a challenge:

• 30% of preterm labor spontaneously resolves.¹
• 50% of patients hospitalized for preterm labor actually give birth at term.²
• Less than 10% of women with the clinical diagnosis of preterm labor actually give birth within 7 days of presentation.³


Predictors of PTB in Symptomatic Patients Triage

Subjective clinical signs and symptoms
- Uterine contractions
- Cramping
- Bleeding

Objective findings
- Presence of fetal fibronectin (fFN)
- Cervical changes
- Transvaginal cervical length, as available
- Combination of clinical findings

Uterine Contractions: A Diagnostic Challenge

- Uterine contractions alone are a poor positive predictor of true preterm labor\(^1\)
- Contractions occur 4 or more times an hour in ~25% of pregnancies < 32 weeks\(^2\)
- Many women diagnosed with preterm labor based solely on criteria of 6 or more uterine contractions per hour will deliver at term\(^2\)


Biochemical Marker for Risk Assessment: Fetal Fibronectin

- Adhesive glycoprotein “glue” at the maternal-fetal interface
- Presence in cervicovaginal secretions highly associated with risk of preterm delivery

Guidelines for fFN Specimen Collection

Obtain specimen prior to any examination or manipulation of the cervix:
- Digital examination
- Vaginal ultrasound
- Microbiologic culture
- Pap test

Specimen should not be obtained in the presence of:
- Cervical dilatation ≥3 cm
- PPROM
- Soaps, gels, lubricants, or disinfectants
- Cervical cerclage
- Moderate or gross vaginal bleeding
- Sexual intercourse within 24 hours,* but negative results are valid

*Positive results should be disregarded and patient should be re-tested in 24 hours.
### fFN Specimen Collection Procedure

- During speculum examination, lightly rotate swab across posterior fornix of vagina for 10 seconds to absorb cervicovaginal secretions.
- Remove swab and immerse polyester tip in buffer; break shaft at score even with top of tube.
- Align the shaft with hole inside the tube cap and push down tightly over shaft, sealing tube; ensure shaft is aligned to avoid leakage.


### The fFN Test: Key Predictor of SPTB

**FDA-approved for use in assessing risk of preterm delivery:**

- In women with symptoms of preterm labor from 24 weeks, 0 days through 34 weeks, 6 days of gestation.
- In conjunction with other clinical information during routine screening of women without symptoms of preterm labor from 22 weeks, 0 days through 30 weeks, 6 days of gestation.


### fFN in Symptomatic Patients: Negative fFN

Allows for better targeting of hospital resources.

**NPV for Delivery Within:**

- 7 days = 99.5%
- 14 days = 99.2%
- < 37 weeks = 84.5%

**Benefits of a Negative Test:**

- Less intervention
- Avoid hospitalizations
- Provider and patient reassurance

fFN in Symptomatic Patients: Positive fFN
Identifies group for intervention

PPV for Delivery Within:
- 7 days = 12.7%
- 14 days = 16.7%
- < 37 weeks = 44.7%

Benefits of a Positive Test
- Identify group that can be targeted for intervention
- Opportunity for antenatal steroids
- Preparation for optimal neonatal care

Adapted from Peaceman AM, et al. Fetal fibronectin as a predictor of preterm birth in patients with symptoms: A multicenter trial. 

Another Diagnostic Tool: Cervical Length

Normal Cervix
Short and Funneled Cervix


CL and fFN Combined Improve Prediction
Delivery probability profile for nulliparous patients

Majority of patients with a short cervical length (<25 mm) and negative fFN deliver at term.
Addition of fFN to patients with a short cervical length (22-24 weeks) can help to further stratify risk.

A Powerful Combination of Diagnostic Tools
fFN + Cervical Length
Symptomatic Patients, Gestational age ranges: 22-35 weeks

<table>
<thead>
<tr>
<th>Timing of Birth</th>
<th>NPV</th>
<th>PPV</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;7 days</td>
<td>98.9%</td>
<td>45.4%</td>
</tr>
<tr>
<td>&lt;14 days</td>
<td>96.4%</td>
<td>10.3%</td>
</tr>
<tr>
<td>&lt;34 weeks</td>
<td>91.5%</td>
<td>36.8%</td>
</tr>
</tbody>
</table>

Screening efficacy of fFN plus CL for prediction of preterm birth (n = 1,194)

Pooled data from nine studies

The most common definitions of short cervix were <20 mm, ≤26 mm, and <25 mm

Adapted from: DeFranco EA, Lewis DF, Odibo AO. Improving the screening accuracy for preterm labor: is the combination of fetal fibronectin and cervical length in symptomatic patients a useful predictor of preterm birth? A systematic review. AJOG. 2013;208:233.e1-6

Interventions for Fetal Protection

- Antenatal Corticosteroids
- Magnesium Sulfate for Fetal Neuroprotection
- Hospitalization and/or Transport
- Tocolytic Therapy

For Symptomatic Patients

Management Strategies of Preterm Labor

ACOG Recommendations on Antenatal Steroids

Timing

- A single course of steroids is recommended for women between 24-34 weeks who are at risk of preterm delivery within 7 days. (Level A)
- A single course of repeat steroids should be considered in women whose prior course of steroids was administered at least 7 days previously and who remain at risk of preterm birth before 34 weeks of gestation. (Level B)

Dosing

- Betamethasone (12 mg) 24 hours apart for two doses
- Dexamethasone (6 mg) every 12 hours for four doses.

Why This Matters:
Antenatal Corticosteroids Benefit at 24-34 weeks

A review of 21 studies (3,885 women and 4,269 infants) showed that ACS led to reduction in:
- Neonatal death (NND) 30%
- Respiratory distress syndrome (RDS) 35%
- Intraventricular hemorrhage (IVH) 50%
- Cerebroventricular hemorrhage 50%
- Necrotizing enterocolitis (NEC) 55%
- NICU admissions 20%
- Early systemic infections 50%

Importance of Appropriate Steroid Timing

- Joint Commission measure PC-03 to improve the number of PTL patients that receive a dose of steroids.
- Recognition of the need for protocols that help to determine the patients most likely to benefit from steroids.

When delivered in 7 days, steroids demonstrated a reduction in the likelihood of neonatal morbidity.
How Are We Doing?
14 year study looking at antenatal steroid timing relative to delivery

- Optimal ACS administration: proportion of live births at 24-34 weeks of gestation exposed to ACS between 24 hours and 7 days before delivery.
- Suboptimal ACS administration: proportion of live births at 24-34 weeks of gestation exposed to ACS less than 24 hours or more than 7 days before delivery.
- Questionably Appropriate ACS administration: proportion of live births at 35 weeks of gestation or greater exposed to ACS.


In 2012:
- 34%
- 23%
- 1.7%

How Are We Doing?
2015 Study: ACS delivery in relation to fFN and CL results

- ACS are frequently administered to women with symptoms of preterm labor but at low risk for delivery <7 days


Harms of Repeat Prenatal Corticosteroid Treatment

- Could increase risk of infection
- Suppress pituitary-adrenal function for mother and baby
- Reduction in size at birth
- Trends towards higher rate of cerebral palsy among children at 2-3 years
- Animal studies shown delayed myelination and decreased growth in all areas of the fetal brain, especially the hippocampus

ACOG Guideline on Tocolytic Agents

- The evidence supports the use of first-line tocolytic treatment with beta-adrenergic agonist therapy, calcium channel blockers, or NSAIDs for short-term prolongation of pregnancy (up to 48 hours) to allow for the administration of antenatal steroids.
- Maintenance therapy with tocolytics is ineffective for preventing preterm birth and improving neonatal outcomes is not recommended for this purpose.

Benefits of tocolytics are to safely transport patient to optimal level hospital and to get a full course of steroids on board.


ACOG Guidance on Magnesium Sulfate for Fetal Neuroprotection

- Evidence suggests potential neuroprotection benefit
- Decreased severity and risk of cerebral palsy in surviving infants if administered if birth is anticipated before 32 weeks of gestation
- Institutions should develop guidelines regarding inclusion criteria, treatment regimens, concurrent tocolysis, and monitoring in accordance with one of the larger trials


Perinatal Care: Improving Outcomes
Standardization of Practice to Improve Outcomes

In a recent Committee Opinion, ACOG stated:  

- Protocols and checklists should be recognized as a guide to the management of a clinical situation or process of care that will apply to most patients.
- Obstetrician-gynecologists should be engaged in the process of developing guidelines and presenting data to help foster stakeholder buy-in and create consensus, thus improving adherence to guidelines and protocols.

Benefits of Standardization in PTL Management: In Practice

- Identifying those patients in true labor will benefit all women who present in triage with signs and symptoms of suspected preterm labor.
- Hospitals providing all levels of care will achieve the following outcomes within a relatively brief timeframe:
  - Timely and appropriate interventions
  - Optimal maternal-fetal safety
  - Hospitalization of only those patients at greatest risk for preterm delivery
  - Effective transport of preterm labor patients to higher, more appropriate levels of care
  - Avoidance of unnecessary treatment, interventions, and medications

Cost Savings – Protocol Adherence

- Standardizing preterm labor evaluation reduces unnecessary admissions for observation resulting in significant cost savings.
  - When compared to prior year, 56% reduction in admission rate for preterm labor
  - Estimated annual savings of $40,000
- Introducing fFN to triage reduces length of stay:
  - Average length of stay before and after fFN introduction:
    - 5.2 days prior to IFN
    - 0.6 days after IFN
Reduced the percentage of patients admitted for preterm labor by 56%.

Standard Protocols Help Avoid Unnecessary Healthcare Costs

If a standard protocol was adopted nationally, it would lead to approximately $560 Million in cost savings.

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Standard Protocols Help Avoid Unnecessary Healthcare Costs

Hospital admissions trends before, during and after the introduction of IFN

- $963K annual decrease in cost of admissions for PTL without delivery
- $811K net decrease in cost of PTL
- 51% reduction in average number of hospital days for admissions without PTL


March of Dimes Preterm Labor Assessment Toolkit (PLAT)

Preterm Labor Assessment Toolkit

March of Dimes Preterm Labor Assessment Toolkit (PLAT)
Step 1: Assessment/Supportive Care

1. Place the patient in the triage or labor room for evaluation, which should be completed in 2 to 4 hours
2. Reassure the patient and her family with careful explanation of all procedures
3. The registered nurse will review the prenatal record and inquire about previous preterm deliveries
4. Obtain objective data:
   - External monitor for contractions and fetal heart pattern
   - Routine labs
   - SSE: assess for ruptured membranes, obtain fFN (if ordered)
   - SVE: assess cervical status
   - Preterm labor screen: TVU and/or fFN test
5. Inform OB provider
Step 2: Disposition
Option A — Preterm Labor is Identified

If regular uterine contractions are accompanied by:
   a) Initial SVE with cervical dilation of at least 2 cm AND/OR
   b) Short cervix ≤20 mm long by TVU between 20 and 28 weeks OR
   c) Repeat SVE notes change in cervix (dilation and/or effacement)

Then:
1. Notify provider
2. Administer antenatal corticosteroids if between 24 and 34 weeks gestation
3. Initiate short-term tocolytic therapy, if ordered by provider
4. Admit as inpatient/prepare for transport
5. Activate intervention pathways (e.g., cerclage, vaginal progesterone), if appropriate

*Assumes intact membranes.

Step 2: Disposition
Option B — Preterm Birth Risk Factors

If regular uterine contractions are accompanied by:
   a) Cervix 21-24 mm long by TVU between 20 and 28 weeks gestation AND/OR
   b) Positive fFN between 22 and 34 weeks gestation

Then:
1. Notify provider
2. Consider antenatal corticosteroids (if between 24 and 34 weeks gestation)
3. Consider situational and patient-specific interventions as ordered by provider
4. Discharge disposition after adequate assessment for cervical change:
   Consider increased frequency of assessment

*Assumes intact membranes.

Step 2: Disposition
Option C — Low Risk of Preterm Labor

If regular uterine contractions and results of ALL factors assessed are negative* (cervical dilation of less than 2 cm by SVE, no cervical change at two hours, cervix ≥25 mm long by TVU, negative fFN):

Then:
1. Notify provider
2. Teach patient home care instructions; make awareness of risk factors, if any
3. Make follow-up medical appointment in one week
4. Discharge, if ordered by provider

*Assumes intact membranes.

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9/6/2016
Step 2: Disposition
Option D — fFN & TVU Unavailable

If cervical dilation is less than 2 cm by SVE only (neither fFN nor TVU available):

Recommend serial SVE to assess for cervical change:

1. Wait 2 hours and repeat SVE. Serial SVE may be performed more than once at 2-hour intervals if the symptomatic patient is clinically stable and has major risks for preterm delivery — e.g. prior preterm delivery before 34 weeks or current Estimated Gestational Age (EGA) ≤32 weeks

2. If cervical change, then:
   A. Notify provider
   B. Administer antenatal corticosteroids, if between 24 and 34 weeks gestation
   C. Initiate short-term tocolytic therapy, if ordered by provider
   D. Consider admission as inpatient/preparation for transport

3. If no cervical change, then:
   A. Notify provider
   B. Teach patient home care instructions; make aware of risk factors, if any
   C. Make follow-up medical appointment in one week
   D. Discharge if ordered by provider
Additional Implementation Resources

March of Dimes Nursing Modules • marchofdimes.com/nursing
• Intrapartum Nursing Management of Preterm Labor (online CE module)

Competencies:
• Sterile Speculum Exam Training
  American College of Nurse-Midwives
  midwife.org/Intrapartum-Sterile-Speculum-Examination
• Transvaginal Ultrasound Assessment of the Cervix and Prediction of Spontaneous Preterm Birth
  upToDate.com (Search Transvaginal Ultrasound Assessment. Full article available to subscribers only.)

PART II
Implementing PLAT for Quality Improvement

Rapid Cycle Change

MAP-IT Cycle

Mobilize QI team
  • Identify hospital champions (administrators, MDs, CNMs, RNs)

Assess
  • Explore PLAT implementation as a QI initiative
  • Complete internal baseline survey and chart audit
  • Research current preterm labor policies and procedures
  • Assess existing process and agreement for maternal transport
  • Identify clinical staff training needs and barriers to implementation
  • Determine availability of in-house, rapid IFN and/or TVU and SSE capabilities 24/7
  • Review patient education materials and home care instructions

MAP-IT Cycle

Plan
  • Revise/develop preterm labor protocol, order sets, patient education and home care instructions; secure approval
  • Purchase laboratory and radiology equipment, if needed
  • Develop data collection and evaluation strategies
  • Establish target start date for rollout of the new preterm labor assessment protocol
  • Confirm maternal transport agreements

MAP-IT Cycle

Implement
  • Convene department meetings to build buy-in
  • Conduct clinical staff trainings
  • Hold kickoff event on rollout start date

Track progress
  • Collect and analyze data to track adherence to patient assessment pathway
Measuring Progress in Standardizing Preterm Labor Assessment

- Number of patients who presented with suspected preterm labor
- Number of patients assessed using PLAT algorithm
- Length of patient stay in clinic or on service
- Percentage of patients who received fFN test or TVU
- Percentage of patients who received ACS

Measuring Progress: Diagnostic Procedure Codes

ICD-9 (ICD-10)/CPT/HPCPS codes are available for:
- Presentation for preterm labor
- fFN
- TVU
- ACS administration

Measuring Progress: Admission and Discharge/Transfer Data

Data on the following scenarios will help evaluate impact on safety, patient outcomes and cost reduction:
- Patients triaged in L&D, determined not to be in preterm labor, sent home undelivered, and later delivered at term
- Patients triaged in L&D, determined not to be in preterm labor, sent home, and later delivered preterm
- Patients triaged in L&D, determined to be in preterm labor, and admitted but later sent home undelivered; delivered on a subsequent admission
- Patients triaged in L&D, determined to be in preterm labor, admitted, and delivered preterm on this admission
Measuring Progress: Chart Audit Tool

Chart audit tool is available to download at: prematurityprevention.org

Best Practices for Implementation

- Identify passionate RN, CNM, NP and physician champions
- Collect baseline data to support the need for new or revised policies and procedures. This is a significant driver of moving the change process forward.
- Initiate the change process as a QI project
- Use the implementation checklist contained in PLAT to track implementation steps
- Change takes time and repetition. Therefore, communicate regularly with and educate staff and physicians throughout planning and implementation.

Preterm Labor Assessment Toolkit Resources

- Toolkit implementation guide
- Preterm labor protocol poster
- PowerPoint slide deck overview
- Implementation tools
- Patient education materials

Prematurity Prevention Resource Center: www.prematurityprevention.org
Conclusions

- Preterm birth is still the leading cause of neonatal morbidity and mortality.
- Etiology is heterogeneous and complex with only retrospective diagnosis and not amenable for a single diagnostic test.
- fFN can assist with management decisions for the symptomatic patient.
- The March of Dimes Preterm Labor Assessment Toolkit can provide a standardized guide for the identification and management of women presenting with PTL symptoms.

Thank you.