The Tachysystole Myth:
Uterine Activity in Labor
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Uterine Activity

- Perhaps one of the most important areas of physiology in understanding fetal oxygenation
- Recent studies show a strong correlation between excessive uterine activity and deterioration of fetal acid-base status
- Unfortunately, focus on uterine contraction frequency alone (tachysystole) is not sufficient to provide safe passage

Keys to Successful Induction or Augmentation of Labor

1. Recognition of the differences between terminology, physiology, and management
2. Knowledge in all three areas
3. Knowledge of pharmacology related to oxytocin
4. A team approach that includes a clear plan, with mutual “buy-in”, understanding, and patient understanding & accord

How Did You Do?

- Do we have a shared mental model regarding uterine activity?
- What are the implications for patient safety?
- What are the risk management implications?
- Is it time to standardize our approaches to uterine activity and labor management and support?
- Let’s begin with a quick review...

Definitions – Montevideo units (MVUs)
The average intensity of contractions in mmHg multiplied by the number of contractions in a ten-minute window. MVUs range from 100 to 250 in the first stage, may rise to 300 to 400 in the second stage. Contraction intensities of 40 mmHg or more and MVUs of 80 to 120 are generally sufficient to initiate spontaneous labor.

Definitions - Frequency
Number of contractions in a 10 minute period. Contraction frequency overall generally ranges from 2 to 5 per 10 minutes during labor, with lower frequencies seen in the first stage of labor and higher frequencies seen during the second stage of labor.
Definitions - Duration
Time from the onset of a contraction to the offset, measured from the baseline resting tone. Contraction duration remains fairly stable throughout the first and second stages, ranging from 45 to 80 seconds, not generally exceeding 90 seconds.

Definitions - Intensity
The peak of the contraction less the resting tone. Intensity of uterine contractions generally range from 25-50 mm Hg in the first stage of labor and may rise to over 80 mm Hg in second stage. It is commonly accepted in clinical practice that contractions palpated as “mild” would likely peak at less than 50 mm Hg if measured internally, whereas contractions palpated as “moderate” or greater would likely peak at 50 mm Hg or greater if measured internally.

Definitions - Resting Tone
The intrauterine pressure when the uterus is not contractile. Average resting tone during labor is 10 mm Hg; if using palpation, should palpate as “soft”, i.e., easily indented, no palpable resistance. Increased uterine resting tone is called hypertonus and is usually defined as a resting tone exceeding 20-25 mm Hg, or a uterus that does not palpate as soft if using palpation.

Definitions - Relaxation time
Time from the end of one contraction to the beginning of the next. Not to be confused with resting tone. In first stage, relaxation time of 60 seconds is considered normal, relaxation time may decrease in second stage as contraction frequency increases.

NICHD Summary Terms
Contraction frequency is considered normal when there are $\leq$ 5 contractions in 10 minutes, averaged over a 30 minute window. If there are $>$ 5 contractions in 10 minutes, averaged over a 30 minute window, it is called tachysystole. Tachysystole includes spontaneous and stimulated uterine contractions, and should be qualified as to the presence or absence of fetal heart rate decelerations.
Uteroplacental physiology

- The term placenta weighs about 500 gm, with a diameter of about 20 cm and is approx. 3 cm in thickness.
- 700-800 ml of blood (10-15% of maternal cardiac output) perfuses the uterus each minute. 70-90% of this passes through the intervillous space.
- Dependent upon maternal blood pressure.

Factors that affect uterine blood flow

- Uterine contractions
- Hypertonus (abruption, tetany, pitocin)
- Hypotension (epidural block, supine position, hypovolemic shock)
- Hypertension (chronic, PIH)
- Vasooconstriction, endogenous (sympathetic discharge)
- Vasooconstrictors, exogenous

Montevideo Units

- “adequate” defined by Schifrin as greater than 200 Montevideo units (MVUs).
- According to Caldyro-Barcia’s work, normal labor that is spontaneous is generally less than 280 MVUs, although there is wide variation among women.
- In second stage, MVUs may naturally rise to over 300.

How Quickly Does Hyperstimulation* Affect Fetal Oxygenation?

Line represents a 6% decrease over 8 minutes.

Research

Effects of oxytocin-induced uterine hyperstimulation during labor on fetal oxygen status and fetal heart rate patterns

OBJECTIVE: The objective of this study was to evaluate the effects of oxytocin-induced hyperstimulation on fetal oxygen saturation and fetal heart rate patterns.

STUDY DESIGN: The study included 52 women who were enrolled prospectively for hyperstimulation lasting 30 minutes using 2 definitions; group 1: 1 or more but less than 2 contractions in 10 minutes; group 2: 2 or more contractions in 10 minutes.

RESULTS: Hyperstimulation was associated with significant oxygen desaturation (group 1: 1.1 ± 0.5% decrease from 92 ± 14 to 90 ± 14; p = 0.01), and significantly more severe fetal heart rate abnormalities, compared with normal activity.

CONCLUSION: Hyperstimulation is associated with negative effects on fetal status. The more contractions in 30 minutes, the more pronounced the effect.

Key words: electronic fetal monitoring, fetal oxygen saturation, fetal heart rate abnormalities, oxytocin-induced hyperstimulation.
So, what can we do?

- Shift focus to attaining adequate uterine activity vs. avoiding tachysystole
- Agree on physiologically sound guidelines for appropriate uterine activity (recall differences in labor)
- Be vigilant about FHR changes and look for early signs of disrupted oxygenation

What about labor disorders?

**Latent phase**: Considered “prolonged” after 20 hours or more of adequate uterine activity in the nulliparous woman, 14 hours or more in the multip.

Strategies for management include avoiding admission, strict criteria for diagnosis, fluids, and use of cervical ripeners when induction is medically indicated.

High Frequency, Low Amplitude?

Management of Active Phase

- **Active phase disorders**
  - Protraction disorders: a slow rate of cervical dilation
  - Arrest disorders: initial normal progress, then stops, for at least two hours
  - Combined disorders: slow progress followed by arrest
- Traditionally, clinicians used 2 hours of greater than 200 MVUs to diagnose an arrest, but newer research shows that using a guideline of 4 hours of uterine activity greater than 200 MVUs (or 6 hours if the average MVUs were less than 200) will result in up to a 92% vaginal delivery rate with no increased risk to the neonate.
Second-stage disorders

**Prolonged second stage**: 2-3 hours in nullips, 1-2 hours in multips, longer parameters used with epidurals in place

**Arrest of descent**: failure of rotation & descent

Strategy is basically a re-evaluation of the “Three P’s”, using an IUPC in some cases, as well as reviewing EFW, pelvic diameters, and prior labor progress.

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**Pitocin drug insert**

**Pitocin**

(Oxytocin Injection, USP) Synthetic

**DESCRIPTION**

Pitocin (oxytocin injection, USP) is a sterile, clear, colorless aqueous solution of synthetic oxytocin, for intravenous infusion or intramuscular injection. Pitocin is a nonapeptide found in pituitary extracts from domestic animals. It is standardized to contain 10 units of oxytocic hormone/ml, and contains 0.5% Chlorobutanol, a chloroform derivative as a preservative, with the pH adjusted with acetic acid. Pitocin may contain up to 10% of total impurities. The hormone is prepared synthetically to avoid possible contamination with vasopressin (ADH) and other small polypeptides with biologic activity. Pitocin has the empirical formula C₁₆H₂₄N₄O₆·H₂O, (molecular weight 393.39). The structural formula is as follows:

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**Product labeling or...?**

**INDICATIONS AND USAGE**

**IMPORTANT NOTICE**

Elective induction of labor is defined as the initiation of labor in a pregnant individual who has no medical indications for induction. Since the available data are inadequate to evaluate the benefits-to-risks considerations, Pitocin is not indicated for elective induction of labor.

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**Oxytocin Pharmacology & Dosage**

Half-life of 10-12 minutes (in-vivo!), with steady-state plasma concentration achieved in 3-4 half-lives (approx. 30-45 minutes)

Uterine response is within 3-5 minutes of IV administration

Prolonged use may result in downregulation (receptor desensitization) and can actually result in ineffective uterine contractions

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**Oxytocin Dosage & Frequency of Increases**

- Various concentrations, use isotonic IV to avoid hyponatremia
- Starting doses of 0.5-6 μ are supported in the literature, with timing of increases ranging from 15-40 minutes
- No sign. variations in outcomes, but incidence tachysystole with higher doses and more frequent increases have led most experts to agree on a low-dose, low-frequency approach as the safest

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**Ongoing Oxytocin Dosing**

- Dose should be decreased once adequate labor pattern is established
- In second stage, endogenous release and an increase in receptor sites may result in tachysystole if the dosage is not weaned, or if oxytocin was injudiciously begun during transition
- 90% of women at term will have successful inductions with doses of 6mU/min or less, and some authors suggest a limit of 16mU/min
Other Considerations

**Elective Induction:** Yes or no, if yes, what criteria need to be met and what type of informed consent should be obtained?

**Response to tachysystole and restart of oxytocin after discontinuation:** Should these be included in the protocol or guidelines, and does it mandate provider notification?

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**Why should we care?**

**Obstetrics**

Cesarean section and development of the immune system in the offspring


The worldwide rate of cesarean sections (C-section) has quadrupled in the last few decades, making C-section the most common surgical procedure performed in women of childbearing age today. The World Health Organization recommends that the rate of C-sections should not exceed 15%. However, in some countries, the rate of C-sections exceeds the recommendations. The rate of C-sections is currently 37% in developed countries, 15% in developing countries, and 15% in the United States.

This review examines the relationship between the mode of delivery and development of the immune system in the offspring. Recent immunological studies provide evidence that the immune system of the offspring is significantly affected by the mode of delivery. The immune system of the offspring is more mature after vaginal birth, with a lower incidence of allergies, type 1 diabetes, and other chronic diseases. However, it is still unclear whether C-section has a long-term effect on the immune system and the risk of developing chronic diseases. With the increased rate of C-sections, a greater emphasis should be placed on the discussion among healthcare professionals and childbirth educators on the potential consequences of C-section on the health of the offspring.

**What should we do?**

"To decrease cesarean delivery rate in the United States, reducing primary cesarean delivery is the key. Increasing vaginal birth after previous cesarean rate is urgently needed. Cesarean section for dystocia should be avoided before the active phase is established, particularly in nulliparous women and in induced labor."