“What Were You Syncing”
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Objectives

• List the five common types of asynchrony
• Identify ventilator strategies to improve synchrony
• Differentiate ventilation approaches as it relates to the work of breathing
• Review the management and monitoring of PAV™+ breath type
History of Asynchrony

Darn Spirometer
History of Asynchrony

My vent is broken, the patient can't trigger?
History of Asynchrony – Graphics The Windows To The Lungs

Oh I know what that is, double-trigger asynchrony, want me to txt it to you?
Normal Trigger and Cycle Interaction

- Proximal Airway Pressure
- Neural Insp. Time
- Conventional Flow or Pressure Trigger
- Cycle
- Time
Asynchrony: Incidence and Impact

In observed ventilated patients, 24%-27% exhibited asynchrony in greater than 10% of breaths.¹,²

Patients with an ITI ≥ 10% showed four days more in ventilation time and longer ICU and hospital stays.²

Ineffective triggering accounts for 85% of asynchronies.¹

ICU staff physicians were able to detect less than one-third of asynchronies, which was higher than the 16% by residents.³

Patient-Ventilator Asynchrony

- 24% of mechanically ventilated patients exhibit patient-ventilator asynchrony in >10% of their respiratory efforts during AVC and PS ventilation (ineffective triggering and double triggering)

- Patient-ventilator asynchrony during assisted mechanical ventilation

Common Words or Phrases Assessing the Symptoms of Asynchrony

AGITATED

RESTLESS

FIGHTING THE VENT
A Vicious Cycle That Could Affect Outcomes

Patient is mechanically ventilated

1. One study showed that 42% of all increases in sedation were in response to asynchrony during low tidal volume ventilation.²,³

2. Respiratory muscle atrophy begins in as little as 18 hours.¹

3. Although there are multiple reasons atrophy of the diaphragm occurs, it appears that a significant factor is reduced diaphragmatic activity.

4. Patient becomes agitated

5. Patient is sedated to alleviate agitation.


Patient-Ventilator Asynchrony is one of the Most Cited Reasons for Sedation During Mechanical Ventilation

• A study by Pohlman et al showed that 42% of all increases in the amount of sedation were in response to patient-ventilator asynchrony.¹

• The ARDS Network protocol for delivering low Vt directs the clinician to adjust the ventilator or give sedation when there are more than three stacked breaths per minute.

Impact of ventilator adjustment and sedation-analgesia practices on severe asynchrony in patients ventilated in assist-control mode

Methods

• MV patients (n=30) who exhibited severe breath-stacking (double-triggering) asynchrony, defined as Asynchrony Index (AI) ≥ 10%, were identified
  – Patients were all ventilated in Assist Control Ventilation (ACV) at time of enrollment
• Clinicians were observed as they managed the care of an asynchronous patient. Clinician-driven interventions in response to asynchrony were classified into three categories:
  – No intervention
  – Adjustment of ventilator settings
• Increase in sedation/analgesia

Impact of ventilator adjustment and sedation-analgesia practices on severe asynchrony in patients ventilated in assist-control mode

Authors’ Conclusions
Bedside adjustment of ventilator settings is much more effective. Settings changes: Switching from ACV to PSV or increasing inspiratory time in ACV.

The patient is the focus point, and the clinician must adjust the mechanical ventilator to meet the patient’s ventilatory requirements. The goal is to have the ‘right tool for the right job,’ and clinicians must not assume that one ‘tool’ (i.e., set of ventilator parameters) satisfies the needs of different patients.”

“...Sedation and neuromuscular blocking agents should not be used routinely to improve patient-ventilator synchrony. These agents should be used only after clinicians have optimized synchrony, and depression of the patient’s respiratory effort is still required.”

Patient Factors Contributing to Asynchrony

- Resistance
- Compliance
- COPD – intrinsic PEEP
- Minute ventilation
Types of Patient-Ventilator Asynchrony

- Delayed triggering
- Auto triggering
- Ineffective efforts

- Double triggering
- Delayed and early cycling
- Flow asynchrony
Causes of Delayed Triggering

• Intrinsic PEEP (common with COPD patients)
• Ineffective respiratory drive (including caused by sedation)
• Muscle weakness
• Insensitive trigger
Auto-trigger

- When the setting is too low for conditions
- Leaks
- Water in circuit
- Hyper-dynamic cardiac state

Epstein SK. How often does patient-ventilator asynchrony occur and what are the consequences?. *Respir Care.* 2011;56(1):25-38.
CAUTION

THIS SIGN HAS
SHARP EDGES

DO NOT TOUCH THE EDGES OF THIS SIGN

ALSO, THE BRIDGE IS OUT AHEAD
Ineffective Efforts or Triggering

• Most common form of asynchrony\(^1\)
• Can be detected by exam of the pressure and flow curves
• Most commonly occur during exhalation but can occur during inspiration

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Double Trigger
Double Triggering\textsuperscript{1}

• Two consecutive inspirations with very little or no exhalation

• Caused by:
  – High respiratory drive
  – Too low of a set tidal volume
  – Neural inspiratory time is longer than set by operator

Basic Ventilator Parameters and Conflict

- Rate
- Tidal volume ($V_T$)
- Inspiratory pressure
- $E_{sens}$
- Peak flow
- Inspiratory time (I:E ratio)
- Flow pattern
Flow Asynchrony

- Occurs when flow is fixed
- Solution is to increase flow or switch to another mode
Asynchrony Can Occur in Cycling
Where’s the Sense in That?

Delayed cycle

Early cycle
How Do Breaths Cycle Off?

• Volume Control – volume or time
• Pressure Control – time
• Dual modes or adaptive modes – time
• Pressure Support – decay of flow, or pressure target or time
• PAV™*+ mode – cessation of inspiratory effort
The Role of Noninvasive Interfaces and Asynchrony

• Devices will typically have a leak
• What problem does that pose?
  – Delayed cycling off
  – 40% of patients receiving NIV had an asynchrony index >10%\textsuperscript{1}

Challenges With Noninvasive Ventilation

- Identification of auto triggering
- Identification of delayed cycling
- Manual adjustments to correct auto triggering and delayed cycling
Pressure Support Cycling Criteria

• When “B” reaches a percentage of “A”, inspiration ends
Where To Set The Sensitivity?
3,5,7,9 LPM – It would Result in Autocycling

Leak is equal to 13 lpm
Synchrony at Home

Would you like to go out for dinner? What would you like to eat?

Man

Women
Conclusions

• There are many types of asynchrony
• They occur frequently
• Asynchrony is associated with an increased duration of mechanical ventilation\(^1\)
• Modes of ventilation have varying responses to increased demand
• Your skill in graphic interpretation will make the difference!