Ventilator Graphics: More Than Just The Numbers

Rena Laliberte, BS, RRT, CPFT
Clinical Education Specialist
Henry Ford Hospital – Detroit Campus

1

Disclosures

I have no affiliations with any business or organization and nothing to disclose.

2

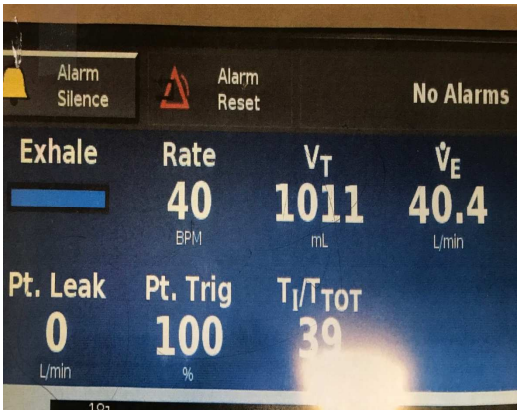
Lecture Objectives

Review	Review the basics graphics
Define	Define synchrony and asynchrony
Explain	Explain the adverse effects of asynchrony
Examine	Examine "The Breath" from initiation through expiratory phase
Recognize	Recognize asynchronies through graphics
Describe	Describe how to correct those asynchronies

3

The Numbers Game

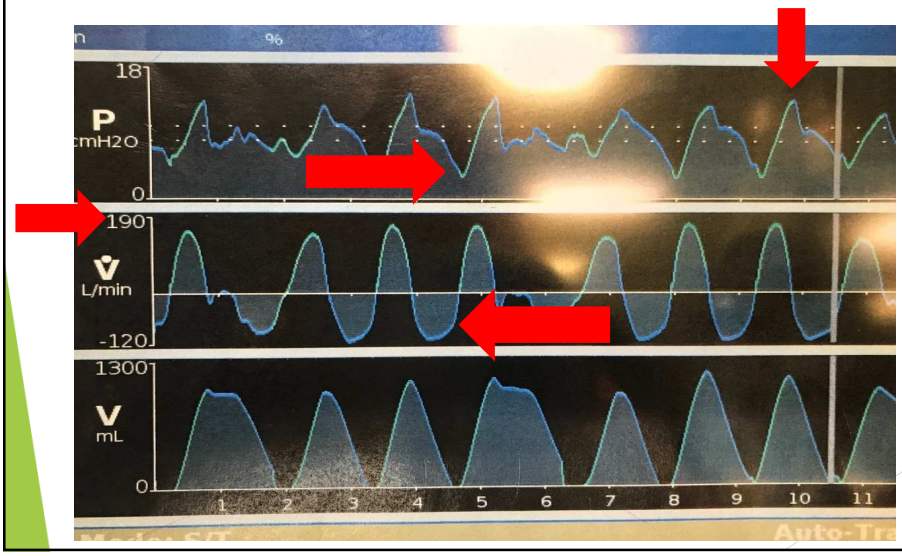
4



Numbers…. This looks bad

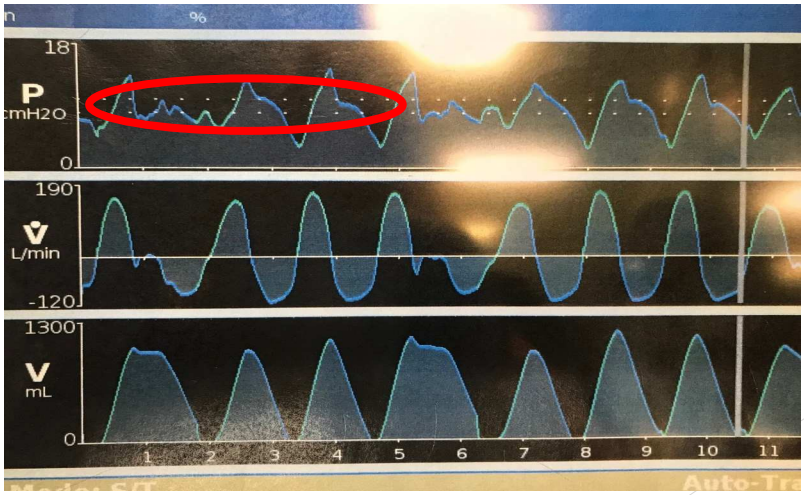
5

Now for the graphics, lets examine



6

Pay attention to every detail on your graphics screen.



7

The Basics

8

The Basics

9

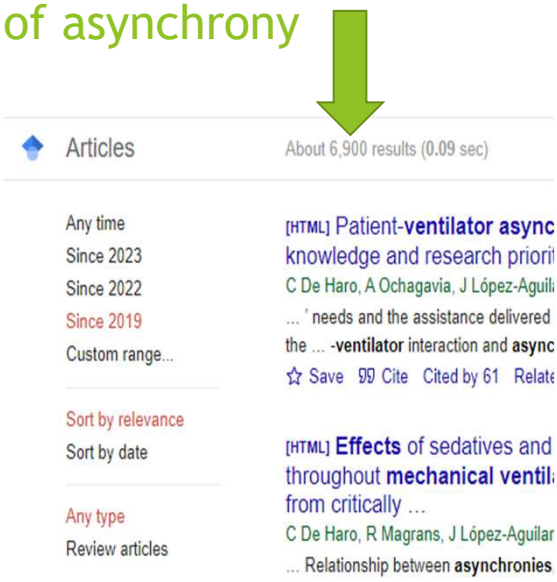
Synchrony and Asynchrony

- Synchrony [sing´kro-ne]
- **1.** the simultaneous occurrence of two events.
- **2.** the linkage of two events by a fixed time interval.
- **3.** synchronism.
- Asynchronism (ā″sing′krŏnizm) [**¹an** + **synchronism**]
- **1.** The failure of events to occur in time with each other as they usually do.
- **2.** Incoordination.

- The medical-dictionary.thefreedictionary.com

10

Effects of asynchrony



11

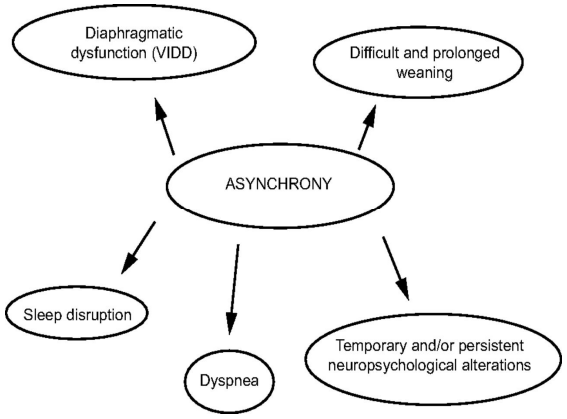
Asynchrony Index

The incidence of asynchronies has been defined as the asynchrony index, which is a percentage value of the total number of asynchronous events divided by the sum of the total ventilator cycles plus the ineffective efforts.[56,84] A high incidence of asynchrony is commonly defined as an asynchrony index > 10%, and it may be related to a patient's discomfort, increased work of breathing, or prolonged weaning due mainly to wasted diaphragmatic energy.[8,48,64] Several studies have reported that an asynchrony index > 10% may significantly increase the duration of mechanical ventilation and the risk of tracheostomy, and it may be associated with a higher mortality rate.[3,56,85] Further studies are needed to define its role in predicting patient prognosis. A schematic representation of the clinical implications of poor patient-ventilator interactions is shown in Figure 7.

Patient-Ventilator Asynchronies: Clinical Implications and Practical Solutions
Lucia Mirabella, Gilda Cinnella, Roberta Costa, Andrea Cortegiani, Li vio Tullo, Michela Rauseo, Giorgio Conti, Cesare Gregoretti
Respiratory Care Nov 2020, 65 (11) 1751-1766; DOI: 10.4187/respcare.07284

12

Effects of Asynchrony



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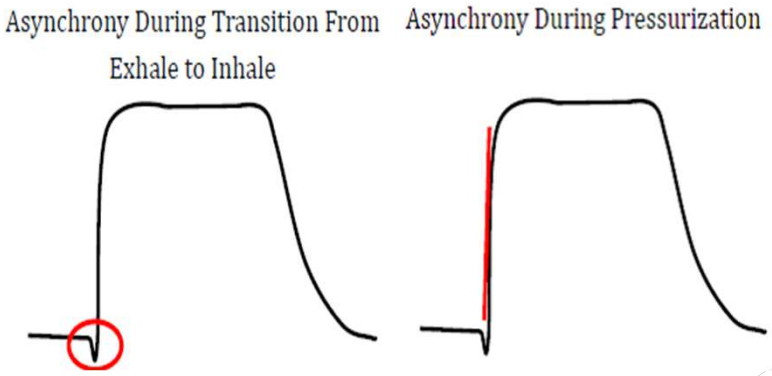
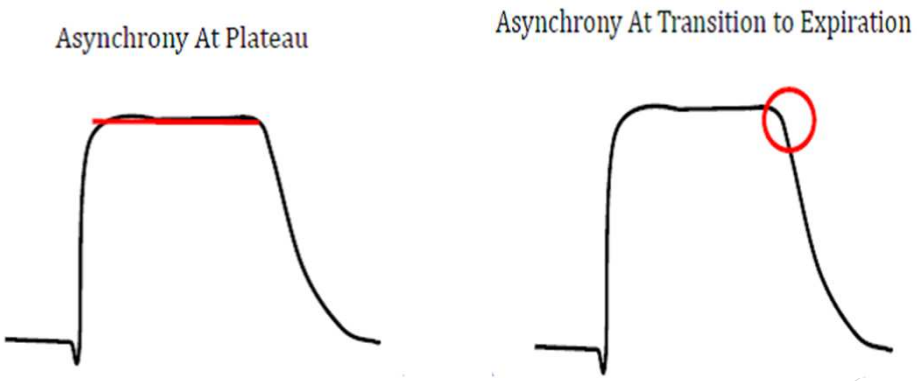
13

Review of a Breath – Pressure/Time Scalar



14

Review of a Breath-Pressure/Time Scalar

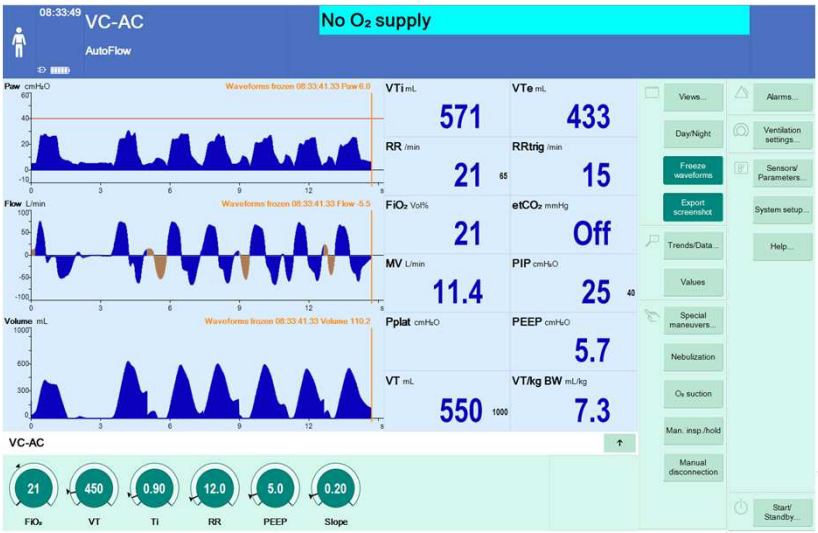


15

Trigger Asynchronies (exhalation to inhalation)

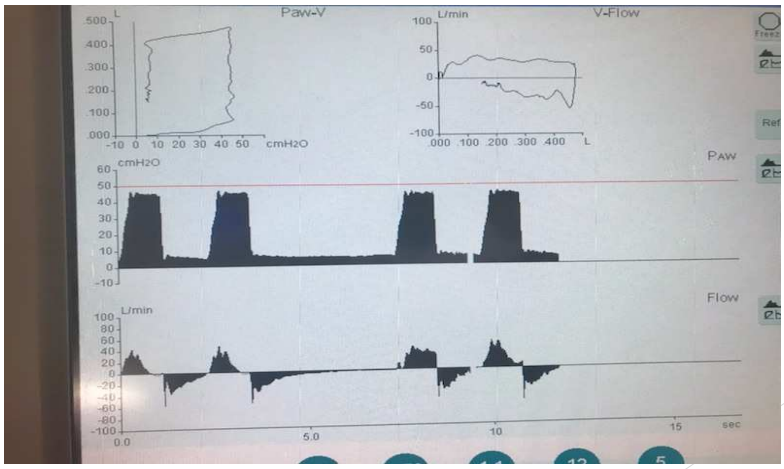
16

Trigger Asynchrony



17

Double Triggering

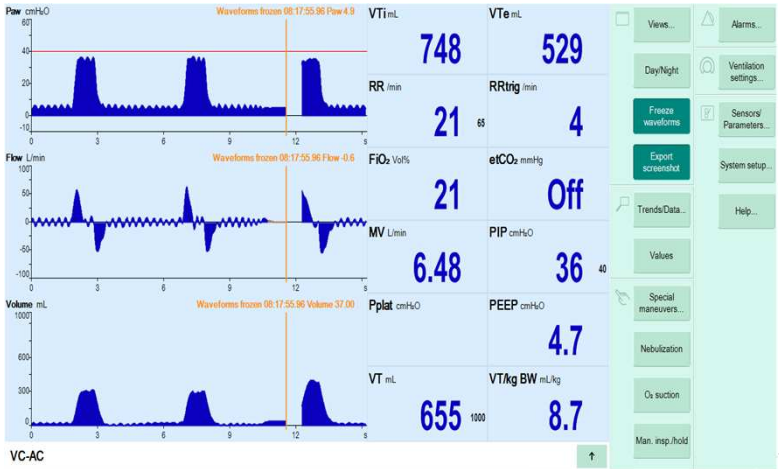


18

Triggers by other causes

19

Triggers by other causes



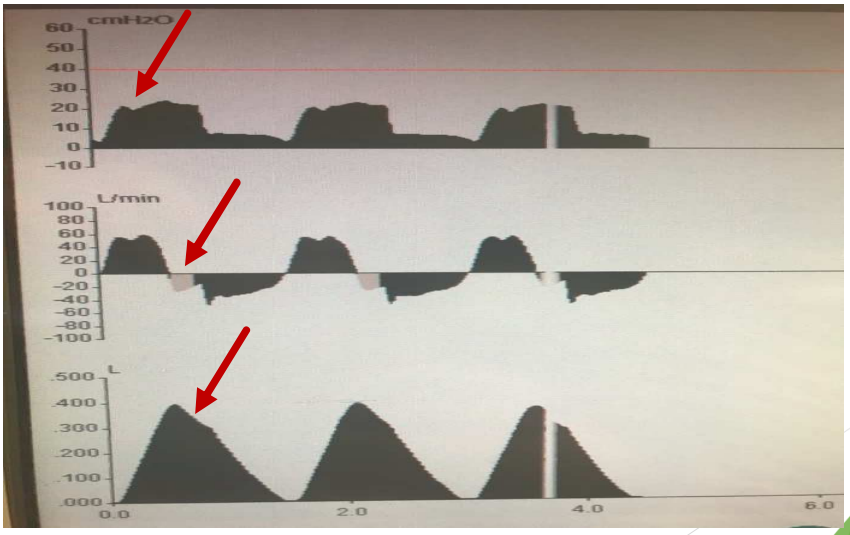
20

Correction of Triggering Issues

- Increase Sensitivity (less sensitive)
- Decrease Sensitivity (more sensitive
- Water in the tubing?
- Cardiac Oscillations? Tubing laying on patient's chest?
- Seizure activity? Other?

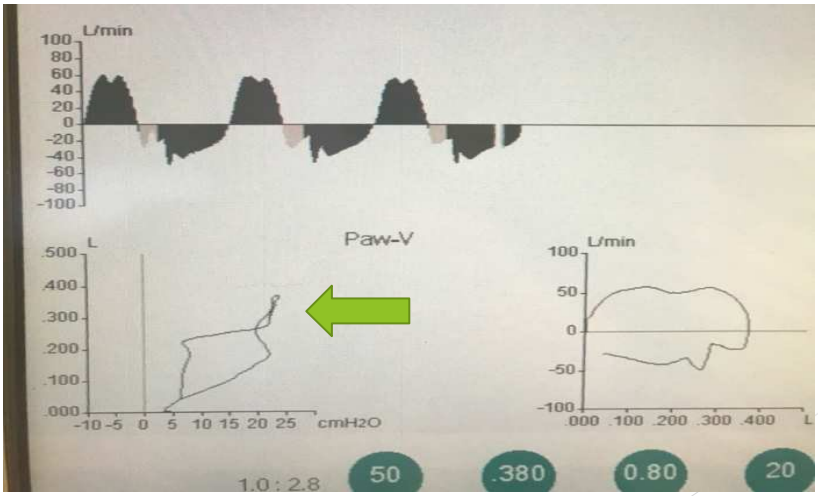
21

Inspiration/Pressurization/Volume Delivery Flow Asynchrony



22

Flow Asynchrony in Pressure and Flow Volume Loops



23

Flow Asynchrony Corrections

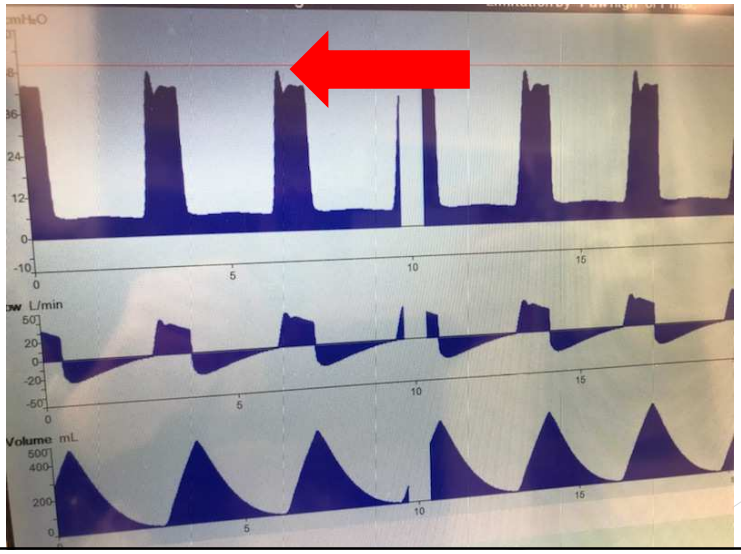
- **Volume Ventilation**
- Increase Flow Rate
- Increase or decrease Inspriratory Time
- Change Flow Pattern

- **Pressure Regulated Volume Control**
- Increase or decrease Inspiratory Time
- Change Ramp/Slope/Rise Time

- **Pressure Control**
- Increase or decrease Inspiratory Time
- Change Ramp/Slope/Rise

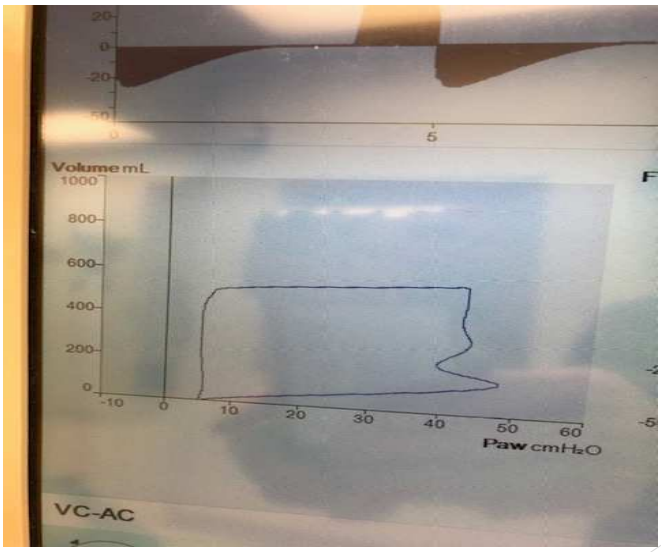
24

Asynchrony at Plateau



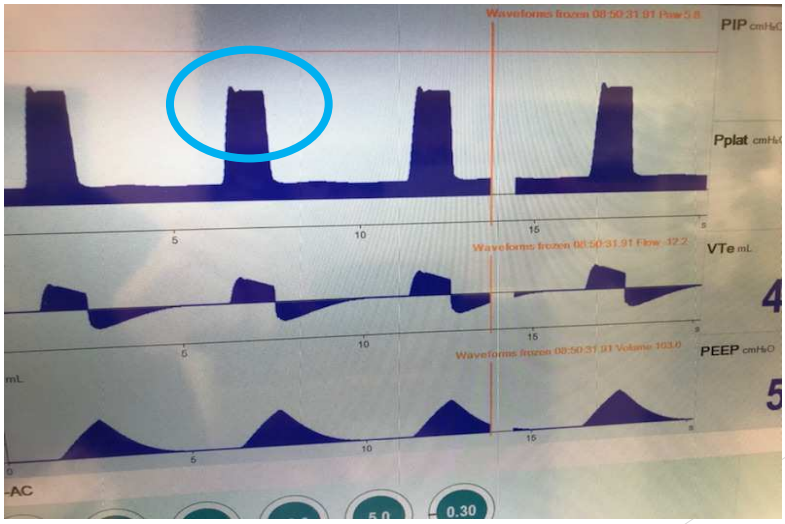
25

Asynchrony at Plateau (PV Loop)



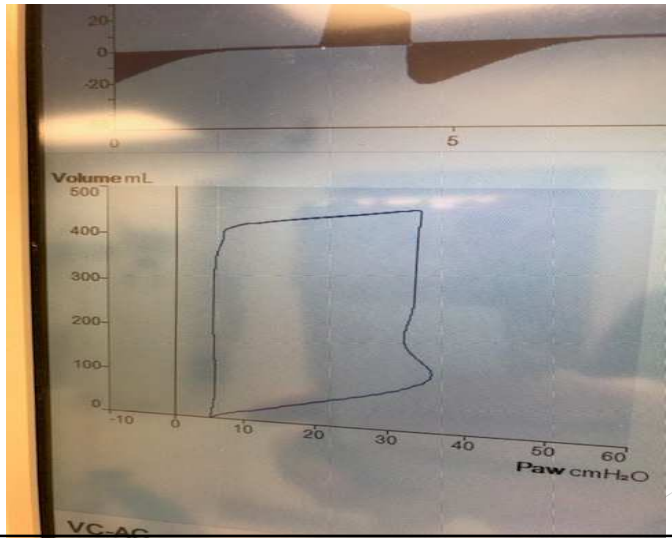
26

Asynchrony at Plateau continued…. Corrected !



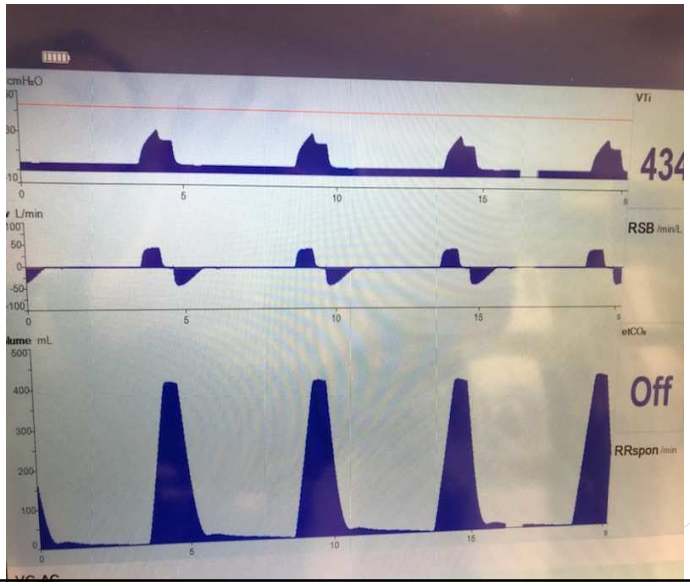
27

Asynchrony at Plateau – corrected PV loop



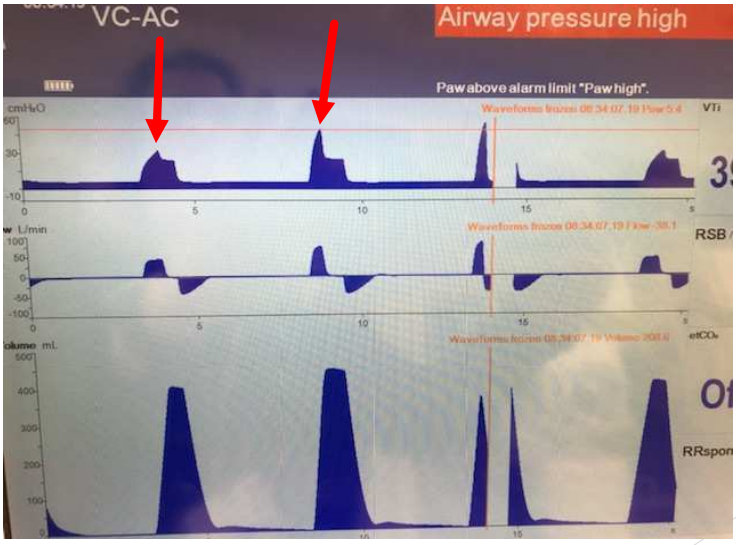
28

Volume Control (40 L/M)



29

Volume Control (40 to 80 L/M)



30

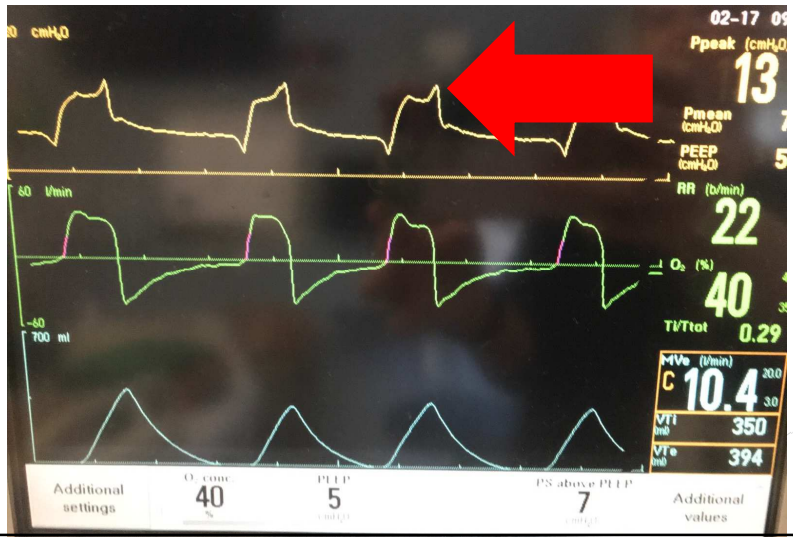
Asynchrony at Plateau (Inspiration)

- **Pressure Regulated Volume Control**
- **Other Pressure Modes**
- Increase Inspiratory Time
- Increase Ramp/Rise/Slope

- **Volume Ventilation**
- Adjust Inspiratory Flow Rate
- Adjust Inspiratory Time

31

Asynchrony at Plateau – Beginning of Expiration

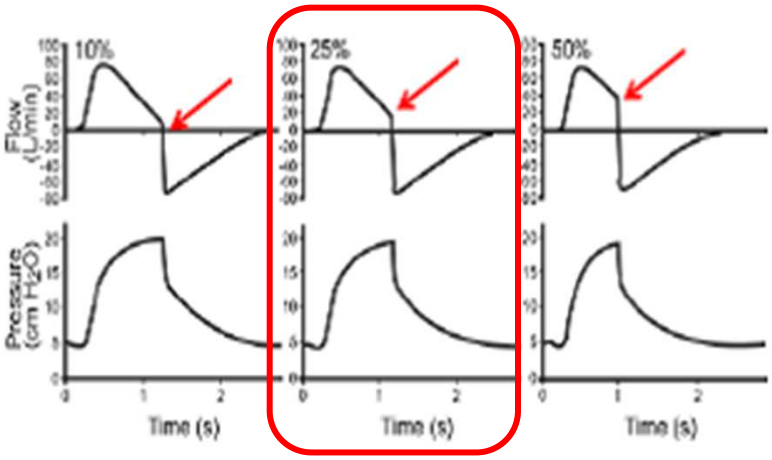


32

Asynchrony at Plateau Beginning of Expiration

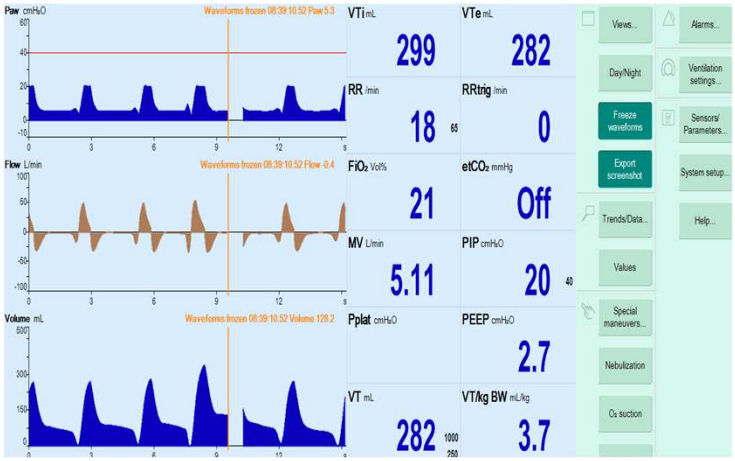
33

Asynchrony at Plateau-Expiration Correction Inspiratory Cycle off (E Cycle)



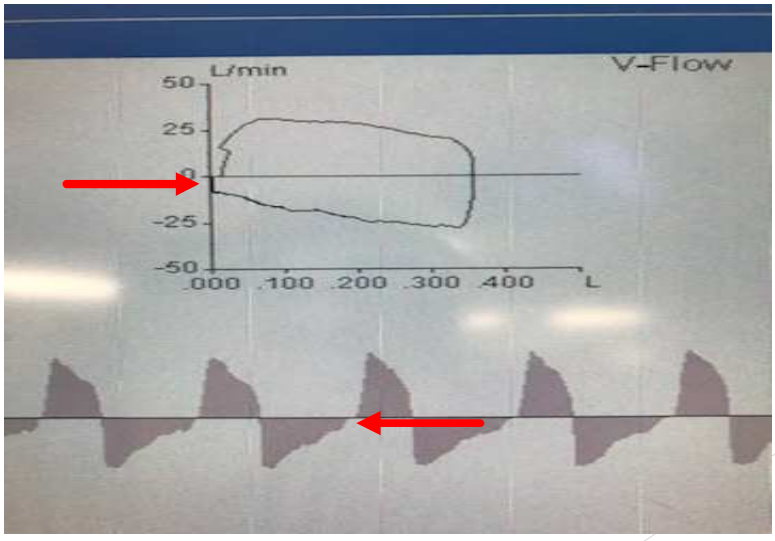
34

% Inspiratory Termination corrected



35

Expiration/Flow Time Scalar/Curve AutoPEEP



36

Expiration – AutoPEEP Corrections

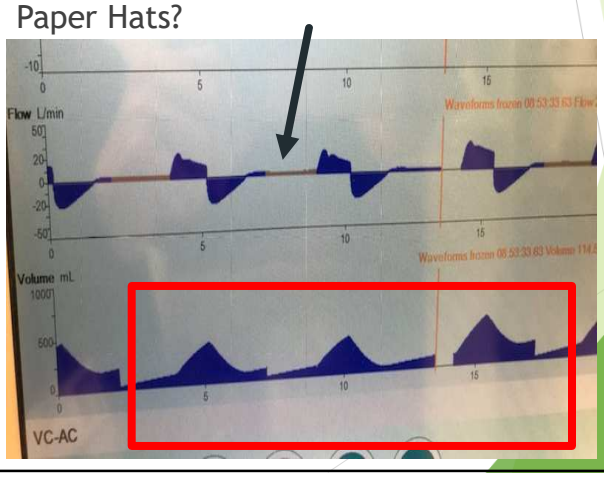
- Bronchodilator
- Adjust Inspiratory Time – DECREASE to increase Expiratory Time on I:E ratio
- Decrease Respiratory Rate
- Increased Patient Respiratory Rate (self inflicted) Pain? Anxiety? Pathology (metabolic) Sedation? Is the increase rate causing additional problems?

37

Ventilator Leaks – Volume Time Scalar/Curve

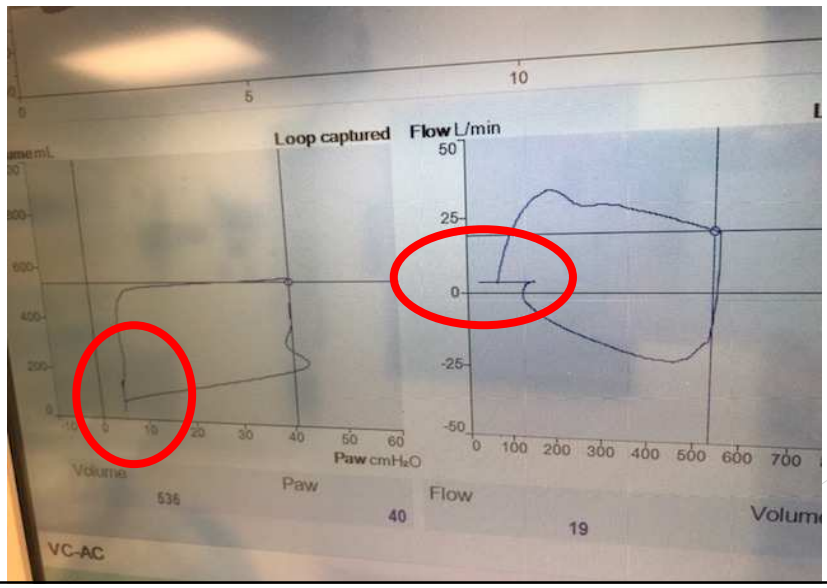
RT School – normal volume time should look like TeePees

Not TeePees – Paper Hats?



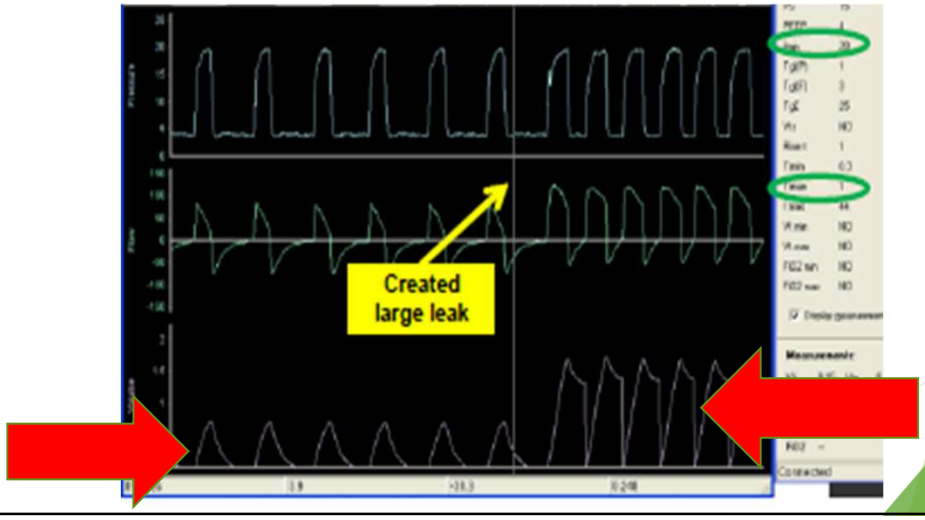
38

Leaks in Pressure and Flow Volume Loops



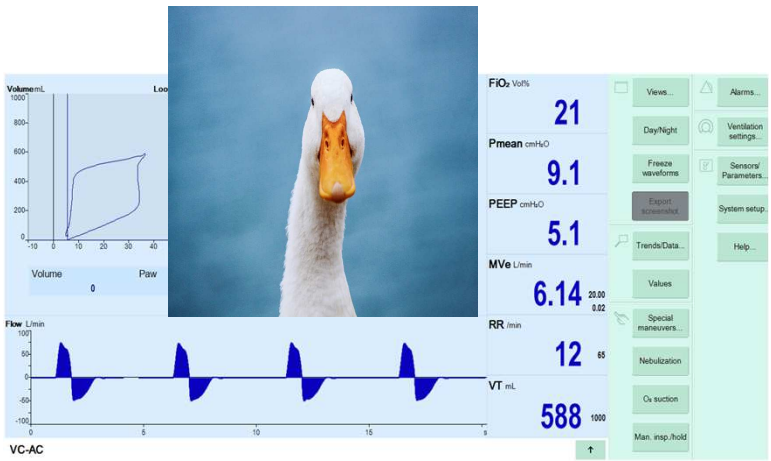
39

Sudden Leak



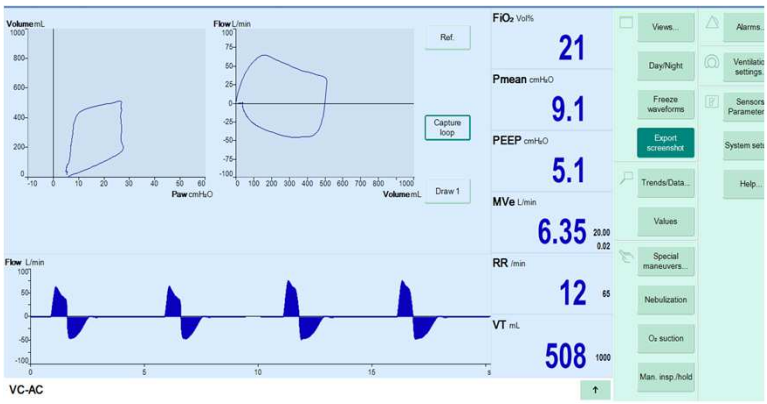
40

Over distention



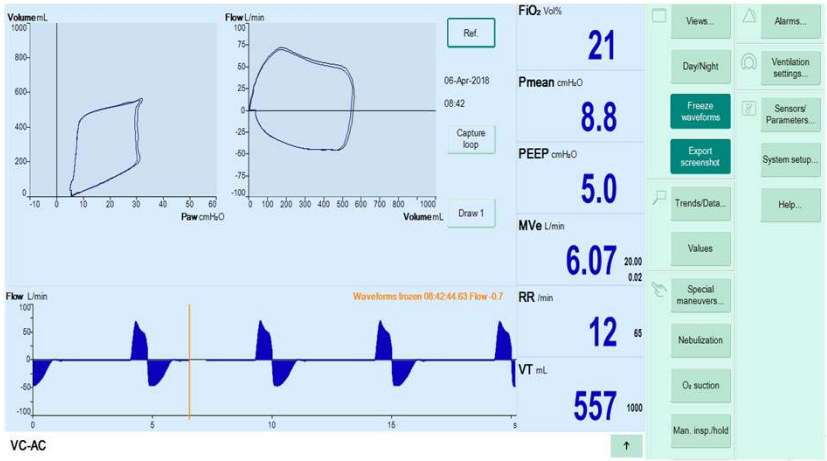
41

Over-distention Corrected



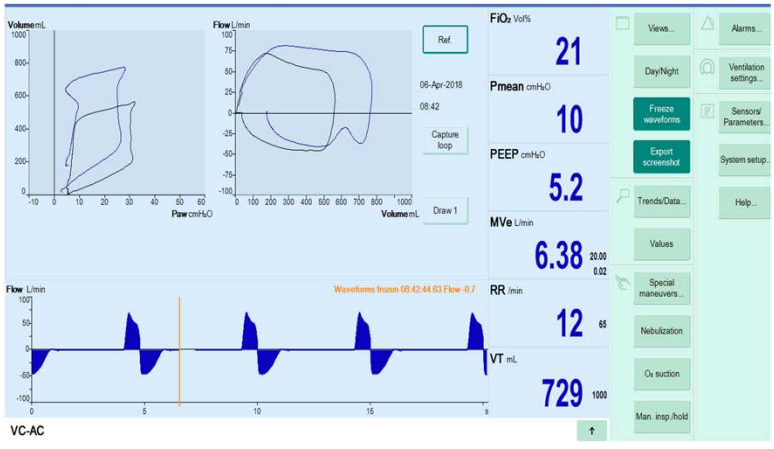
42

Bronchodilator Therapy not Indicated



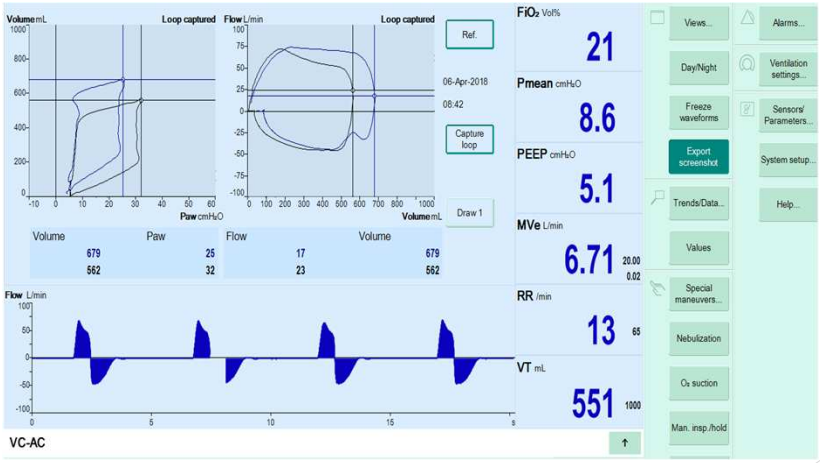
43

Bronchodilator Indicated and Response



44

Bronchodilator Response Measured



45

In Conclusion….

- Numerical values on a ventilator do have value
- Graphics identify asynchronies and where they exist. Corrections provide immediate feedback.
- Graphics are a powerful tool in providing visual talking points when discussing patient/ventilator interactions with the Providers
- Analyzation of Graphics during ventilator assessments provide information that may become more problematic with time.
- KNOW YOUR EQUIPMENT

46


Questions?
Contact Information:
Rena Laliberte, BS, RRT, CPFT
Henry Ford Hospital – Detroit Campus
rlalibe1@hfhs.org

47