

# Ventilator dyssynchrony

Chris Hill



Dysynchrony



# Patient – ventilator dyssynchrony

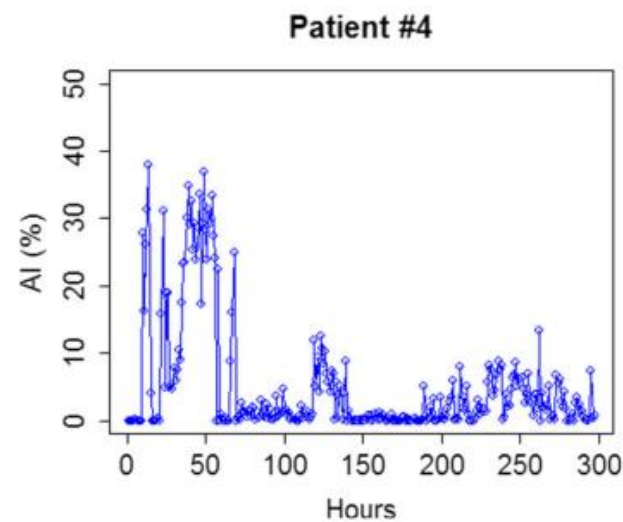
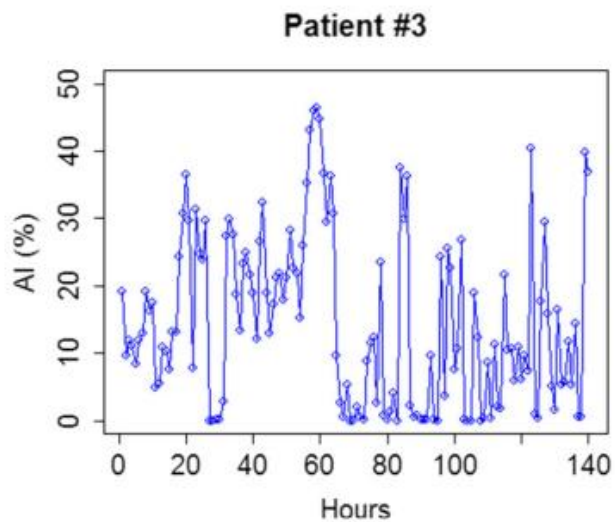
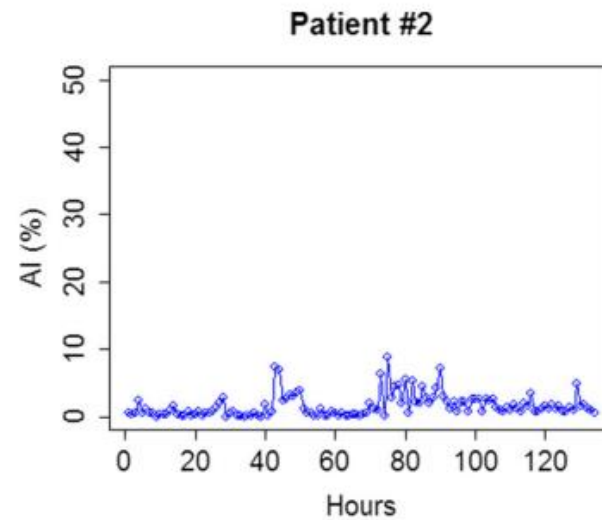
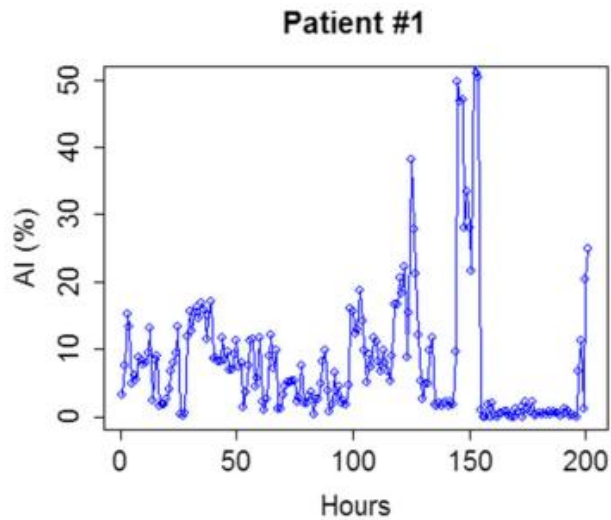


A mismatch between patient demand (neural inspiration and expiration) and ventilator breath delivery

What actually happens? (e.g.)

- Vent alarming, high pressures, patient distressed
- The patient trying to take a breath, but none being delivered
- An autotriggered breath - supposedly triggered by the patient, but with no actual patient trigger
- A breath being delivered but being terminated early, or late, compared with the patient's effort

# Asynchrony index recorded hourly



Blanch et al, 2015

## **Underlying causes include:**

High respiratory drive, for instance in acute respiratory failure

Reduced respiratory drive caused by sedation or hyperventilation

Circuit leaks and cardiac oscillations

# Consequences

“Poor patient–ventilator interaction causes discomfort and dyspnea, increases the need for sedative and paralytic agents, prolongs mechanical ventilation (MV) and intensive care unit (ICU) length of stay, and increases the likelihood of respiratory muscle injury and tracheostomy” (Blanch et al, 2015)

“There is a clear association between asynchrony, ventilator-induced diaphragmatic dysfunction, and duration of mechanical ventilation” (Branson et al, 2013)

## Asynchrony and Dyspnea

Richard D Branson MSc RRT FAARC, Thomas C Blakeman MSc RRT,  
and Bryce RH Robinson MD

### Introduction

#### Defining Asynchrony

Flow Asynchrony, Flow Mismatch, and Flow Starvation

Misadventures

Intensive Care Med (2015) 41:633–641  
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ORIGINAL

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## Asynchronies during mechanical ventilation are associated with mortality

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**Take-home message:** Patient–ventilator asynchronies occur frequently around the clock and in the most common modes of mechanical ventilation. A higher frequency of asynchronies is associated with higher mortality.

**Electronic supplementary material**  
The online version of this article  
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**Abstract Purpose:** This study  
aimed to assess the prevalence and  
time course of asynchronies during

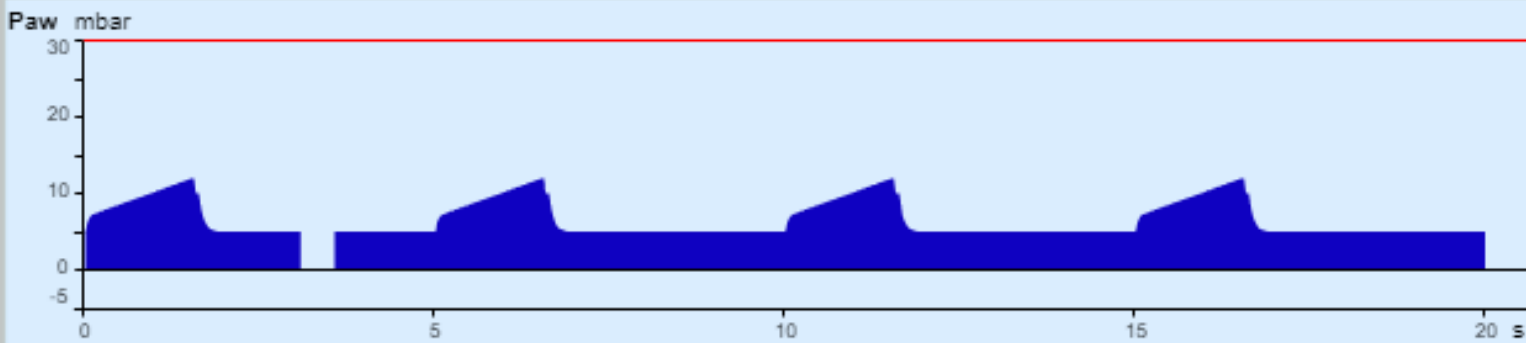


# Recognition

It *may* be recognised by observing the patient, but inspection of ventilator flow and pressure waveforms is a widely described method.

“The prevalence and consequences of asynchronies may be largely underestimated because of a frequent lack of monitoring “ (Dresa et al, 2016).

Also, measurement of oesophageal pressure or diaphragm electrical activity.

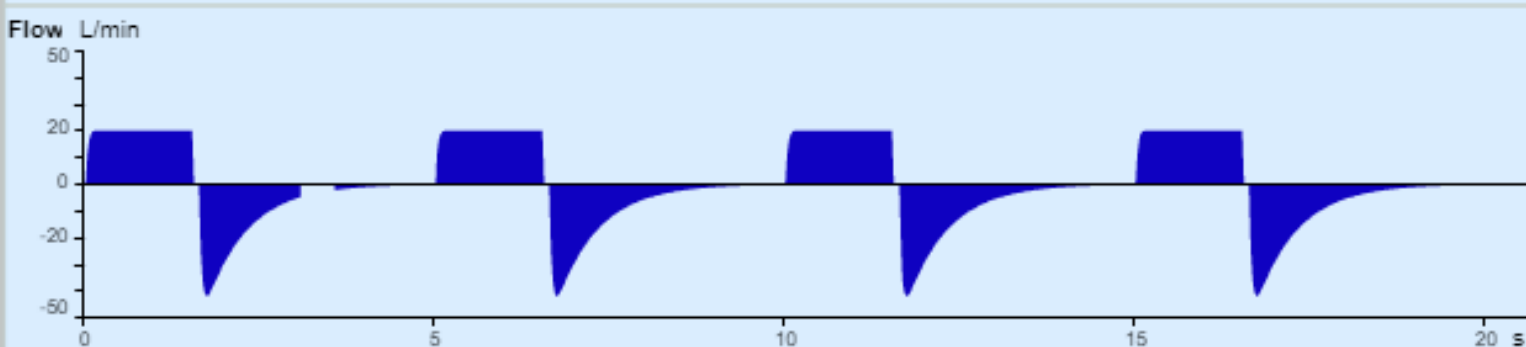


FiO<sub>2</sub> Vol%

**21**

Pmean mbar

**6.5**



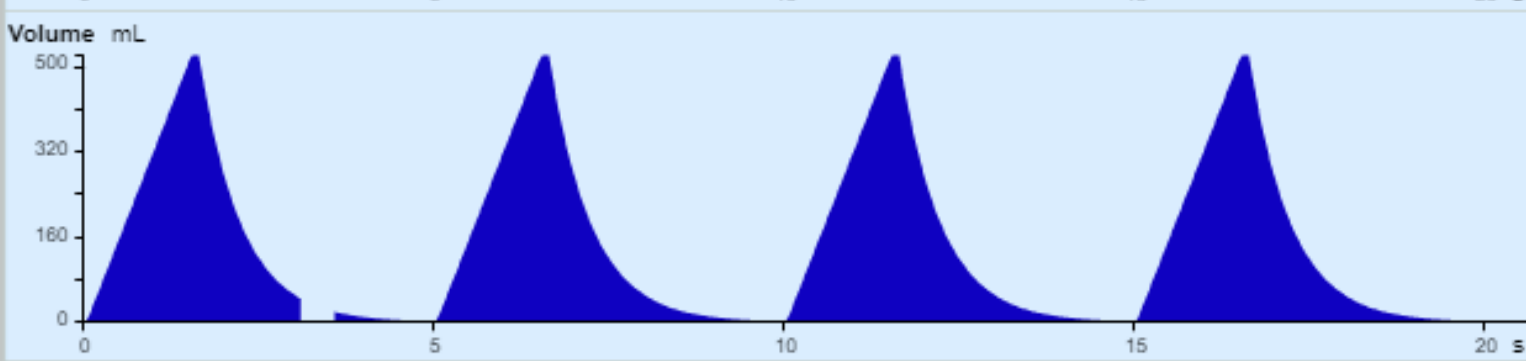
PEEP mbar

**5.0**

MVe L/min

**5.84**

9.00  
4.80



RR /min

**12**

15

VT mL

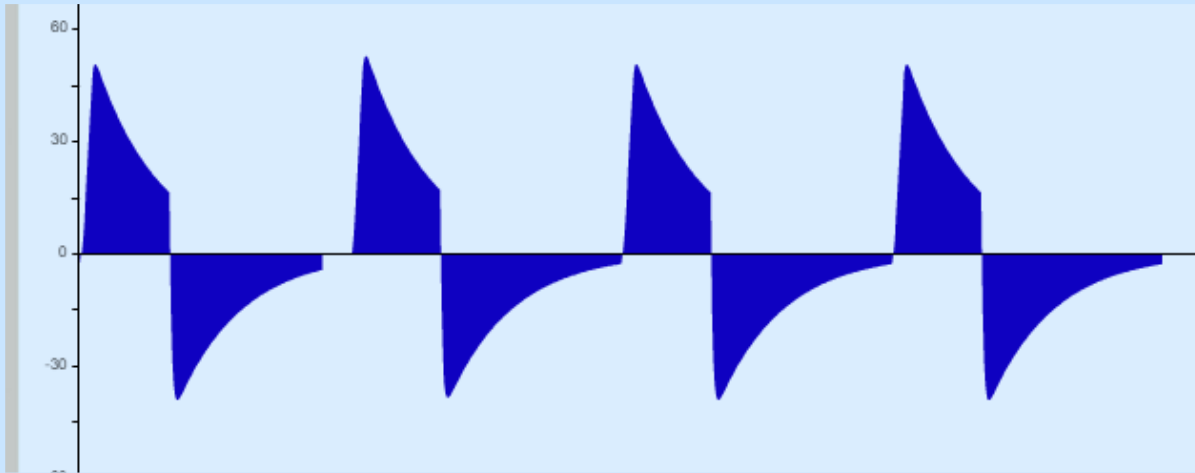
**500**

1000

**VC-AC** ↑

21 → 500 → 1.70 → 12.0 → 5.0 → 20

FiO<sub>2</sub> VT Ti RR PEEP Flow



Flow - time display is very useful

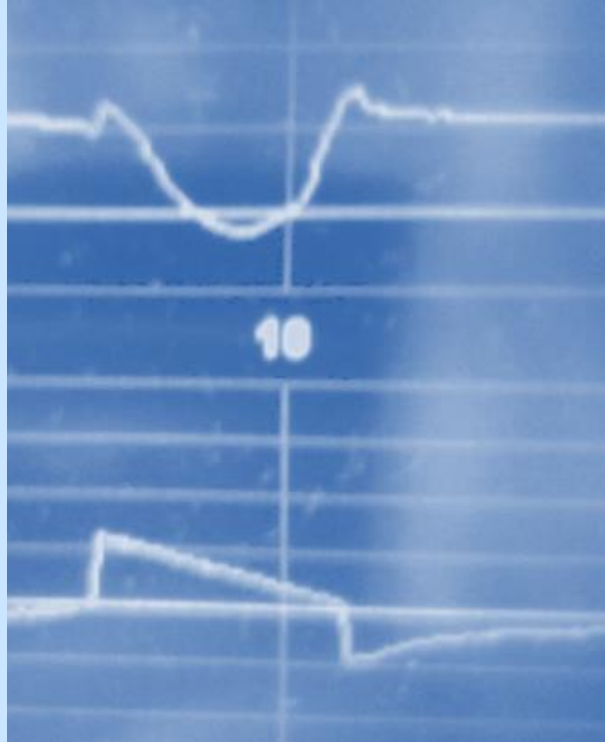
Inhalation depends on interaction of ventilator and patient's lungs

Exhalation depends purely on patient's lungs

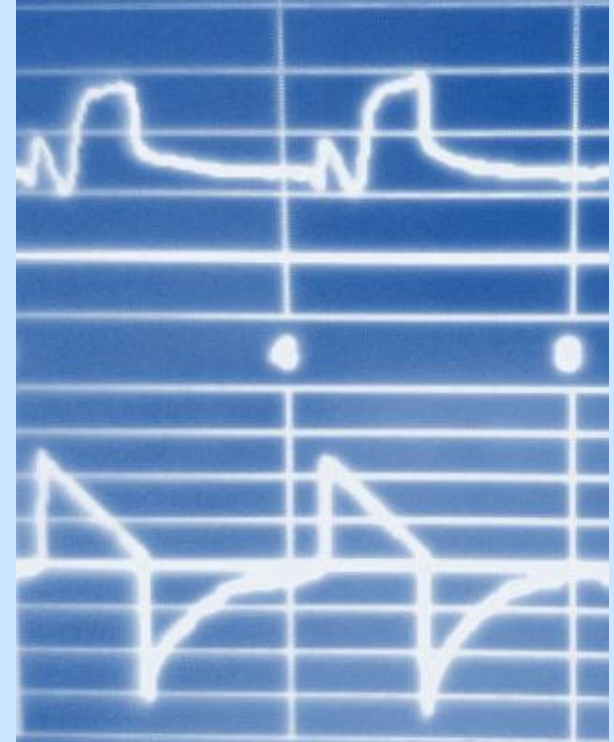
Can also see generally what the patient is doing e.g. in terms of trying to trigger breaths

# Flow dyssynchrony

Pressure

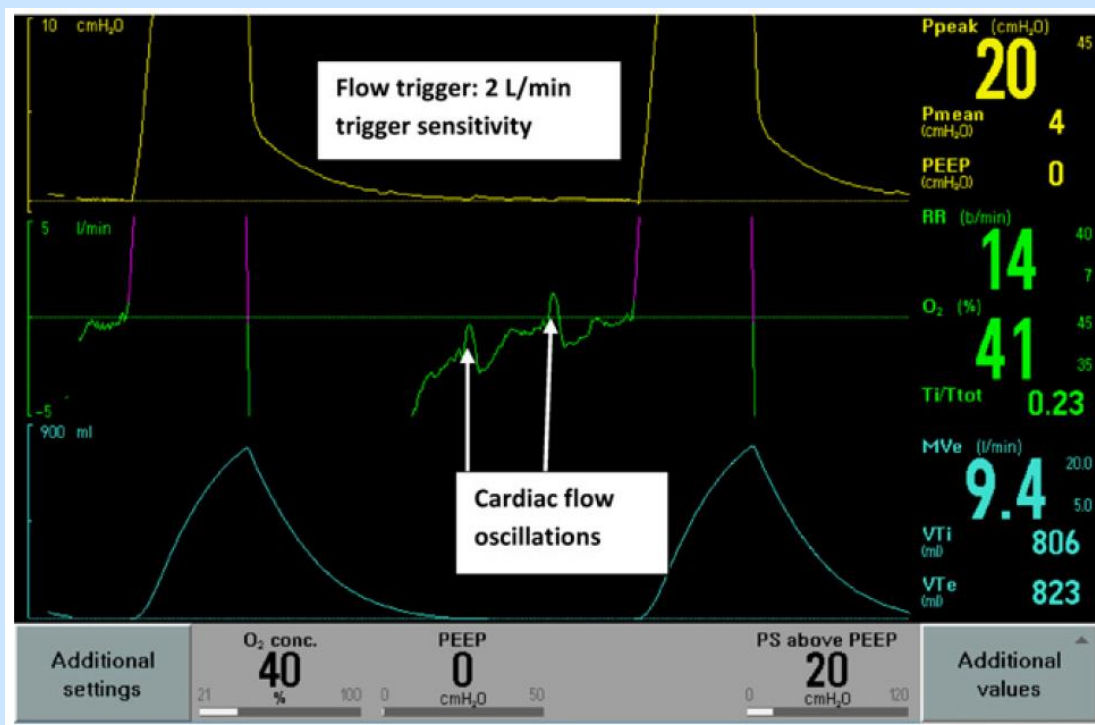


Flow



# One 'dramatic' form of dyssynchrony

Auto-triggering caused by cardiac oscillations can cause brain stem dead patients to appear to be breathing on pressure support ventilation



Arbour, 2012

Intensive and Critical Care Nursing (2012) 28, 321–328

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SciVerse ScienceDirect  
journal homepage: [www.elsevier.com/iccnc](http://www.elsevier.com/iccnc)

ELSEVIER

Intensive and Critical Care Nursing

ORIGINAL ARTICLE

**Confounding factors in brain death: Cardiogenic ventilator autotriggering and implications for organ transplantation**

Richard B. Arbour\*

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Accepted 14 March 2012

**E.g.**

Essentially fit and well female, 30s, admitted with anaphylaxis. Quite unwell in ED – intubated there.

Next day, CVS stable, sedated, ventilated

PSV, but poor compliance (TVs 200 on PS 8) and irregular RR and TVs. Though gas exchange Ok.

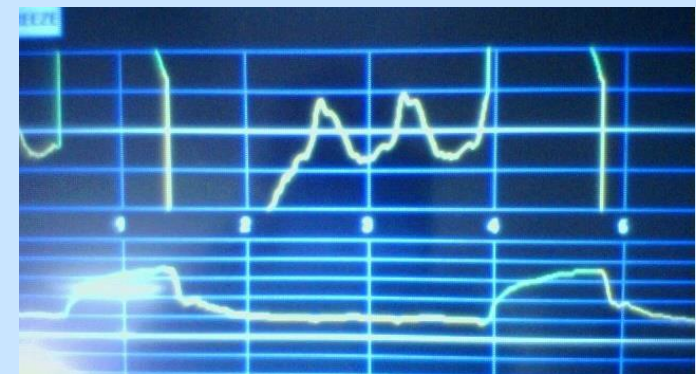
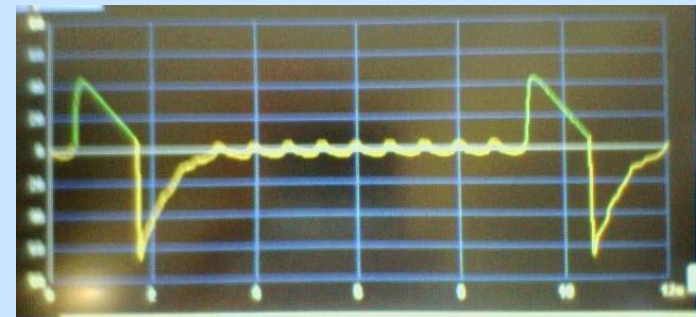
Some thick secretions, had been extremely unwell in ED, ? aspirated

Plan: Keep intubated, wait for improvement

Observation of graphics demonstrated possible autotriggering.

Confirmed by changing to pressure triggering.

Actual respiratory pattern was RR 5 bpm, TVs 900 on PS 8.



Excellent respiratory compliance with good gas exchange.

RR 5, TVs 900 on PS8

Smaller TVs associated with autotriggering

### **New plan**

Decrease opiates and sedation

Extubated later that day



65 year old man following a major elective operation. Arrived on the unit at 9pm on propofol and fentanyl which were weaned overnight.

Weaned to PSV, then when PS reduced to zero on the ward round – noted that background RR of around 40 with small tidal volumes, with also approx. 5 breaths per minute of volumes around 700 ml.

## Summary

Ventilator dyssynchrony is common, poorly recognised, can cause patient discomfort, and possibly poorer outcomes

Ventilator graphics are a form of patient assessment, like others, practice and some knowledge is needed.

Ventilator dyssynchrony can generally be spotted using ventilator graphics