

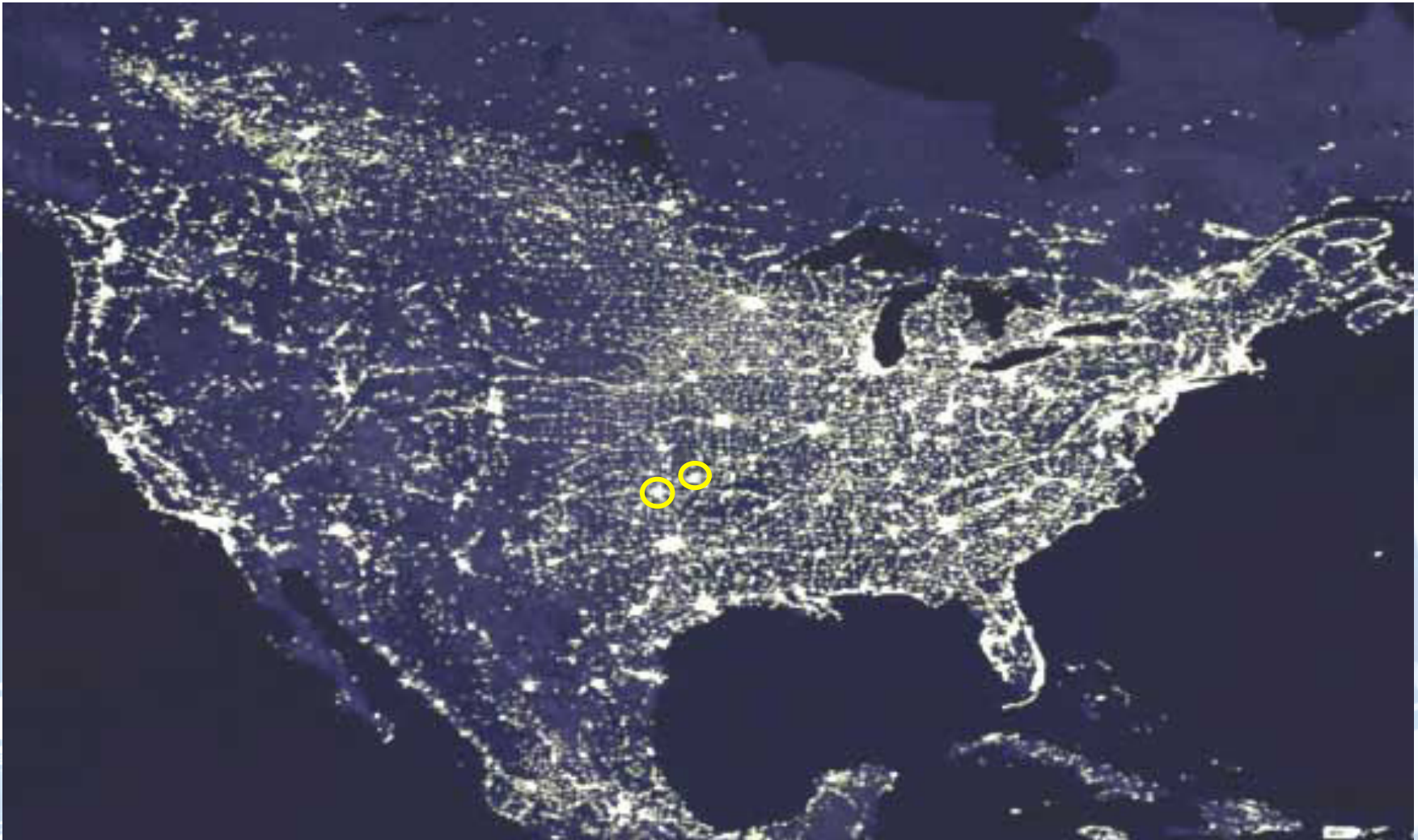
**“If the Waves Ain’t Showin’,
The Tubes Are Gettin’ Yanked from Blowin’”**

**It’s Important to Make Waves: EtCO₂ Analysis
as the Airway Gold Standard**

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EMS System for Metropolitan Oklahoma City & Tulsa



1,100 square miles

Population

- **1.6 million day**

- **1.25 million night**

175,864 calls (2010)

132,224 transports (2010)

75% transports



Tales of the Tubes (2010)

Oklahoma City

- 631 Intubations
- 409 (65%) Cardiac Arrest
- 222 (35%) “Other”

Tulsa

- 577 Intubations
- 345 (60%) Cardiac Arrest
- 232 (40%) “Other”



*Leo says:
“Keep em’ all outta da
goose”*

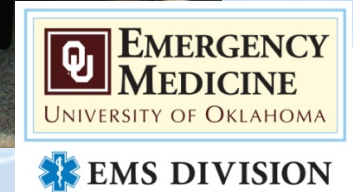


Tales of the Tubes (2010)

- System Medics = 589
- Total Intubations = 1208 (0.7% of calls)
- Intubations/Medic = 2.05



Isn't it about more than this?



Acute Dyspnea – Uncertain Etiology

EMT-Basic Scope of Practice

EMT-B

GENERAL SUPPORTIVE CARE

OBTAIN VITAL SIGNS

O₂ VIA NC, NRB, OR BVM AS APPROPRIATE

APPLY CARDIAC MONITOR (when available)

ASSIST PT WITH PT'S OWN ALBUTEROL INHALER/NEBULIZER (when applicable)

MEASURE END-TIDAL CO₂ & MONITOR CAPNOGRAPH (when available)

ADULT: APPLY CPAP IF INDICATED

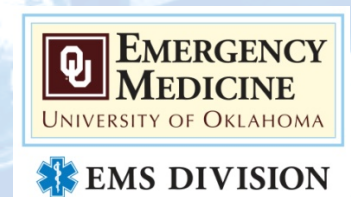
ADULT: OBTAIN 12-LEAD ECG (when available)

ADULT: TRANSMIT 12-LEAD ECG TO RECEIVING EMERGENCY DEPARTMENT (when available)



Ray Fowler's "3 Great Sins of Modern EMS"

- Unrecognized esophageal intubations
- Unsafe ambulance driving
- Paramedic-initiated no loads



“3 Great Concerns of EMS Medical Directors”

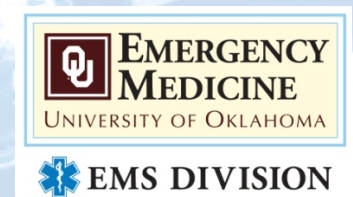
- Safe Airway Management
- Safety of the Public and EMS Personnel
- Safe Refusal of Care Practices



Do the right thing for the right reasons...



**32 year old female...s/p witnessed arrest at home, bystander CPR
EMS resuscitation included CPR, defibrillation, intubation
Transport to Level I Cardiac Arrest Center
& Therapeutic Hypothermia**



July 2008 EtCO₂ OMD Memo

- ***“It is not acceptable to attach a positive pressure ventilatory device to an endotracheal tube without first placing the EtCO₂ sensor in – line with the ventilatory source and endotracheal tube.”***
- “The bottom line is that all tracheal intubations will have EtCO₂ confirmation within 60 seconds of ETT insertion and continuous monitoring of lung ventilation”



OKC & Tulsa Confirmation of Intubation Placement Protocol – July 09

The following sequence is to be used (and its use documented) to verify and maintain correct oral endotracheal placement without fail:

- 1. Visualization of endotracheal tube passage between the vocal cords.**
- 2. Detection of End-tidal carbon dioxide.** *End-tidal carbon dioxide (EtCO₂) detection shall be confirmed within 60 seconds of endotracheal tube placement. The capnography adaptor is to be placed at the bag-valve device-endotracheal tube interface for the first ventilation. The normal waveform indicating correct endotracheal placement reflects a rapid upstroke with the beginning of exhalation, the exhalation plateau ending at the point of EtCO₂ measurement, and a rapid downstroke with the beginning of inhalation. Any waveform that does not show rhythmic rise and fall correlating with assisted ventilations indicates incorrect tube placement and the tube must be withdrawn. **To be perfectly clear, the use of an endotracheal tube for ongoing oxygenation and ventilation is dependent upon continuously measurable capnography waveforms.***



3. **Auscultation. Auscultate the epigastrium.** If epigastric sounds are heard, intubation is to be reattempted. The endotracheal tube placed in the esophagus may be left in place, at the intubator's discretion, until another endotracheal tube is correctly placed and verified. If no epigastric sounds are heard, proceed to **auscultation of the thorax bilaterally**. Breath sounds are best auscultated in the anterior to mid axillary lines. If breath sounds are present on the right and absent on the left, this suggests a right main stem intubation. Withdraw the endotracheal tube 1cm and repeat breath sound auscultation. If necessary, the tube may be withdrawn an additional 1-2cm.
4. **Assessment of physiologic changes.** These include equal rise and fall of the chest, condensation in the endotracheal tube on exhalation, improvement in the patient's color, and improvement in the patient's respiratory distress or failure.



5. *Securing the endotracheal tube with a tube holder and placement of a cervical collar.*

When intubated patients are moved during EMS care, the capnograph must be rechecked for any change. If the waveform continues to show a normal pattern of rapid upstroke with exhalation, exhalation plateau, and rapid downstroke with inhalation, no further repeat confirmation is required. If at any time, the capnograph waveform is abnormal, steps 2-5 must be rechecked and documented. If at any time during patient care there is doubt as to correct endotracheal placement of intubation, you must either reverify by this sequence or reattempt correct endotracheal placement. While the intubator may delegate confirmation steps to his/her colleagues, he or she is ultimately responsible to ensure that a complete confirmation sequence is performed. If the intubator accompanies the patient to the hospital, he or she remains ultimately responsible for ongoing endotracheal tube placement confirmation. If the intubator does not accompany the patient to the hospital by EMSA transport, the primary transporting/treating EMSA paramedic assumes ultimate responsibility for ongoing endotracheal tube placement confirmation.



The 30 Day Suspension – Sept 09

- Medics failing to utilize continuous waveform capnography post-intubation are suspended from paramedic duty for 30 days
 - Airway remediation education
 - Applicable to ALL agencies in the system
 - “Patient Safety Initiative”
 - Supported by EMS & Fire
 - Supported by Administrations & Unions

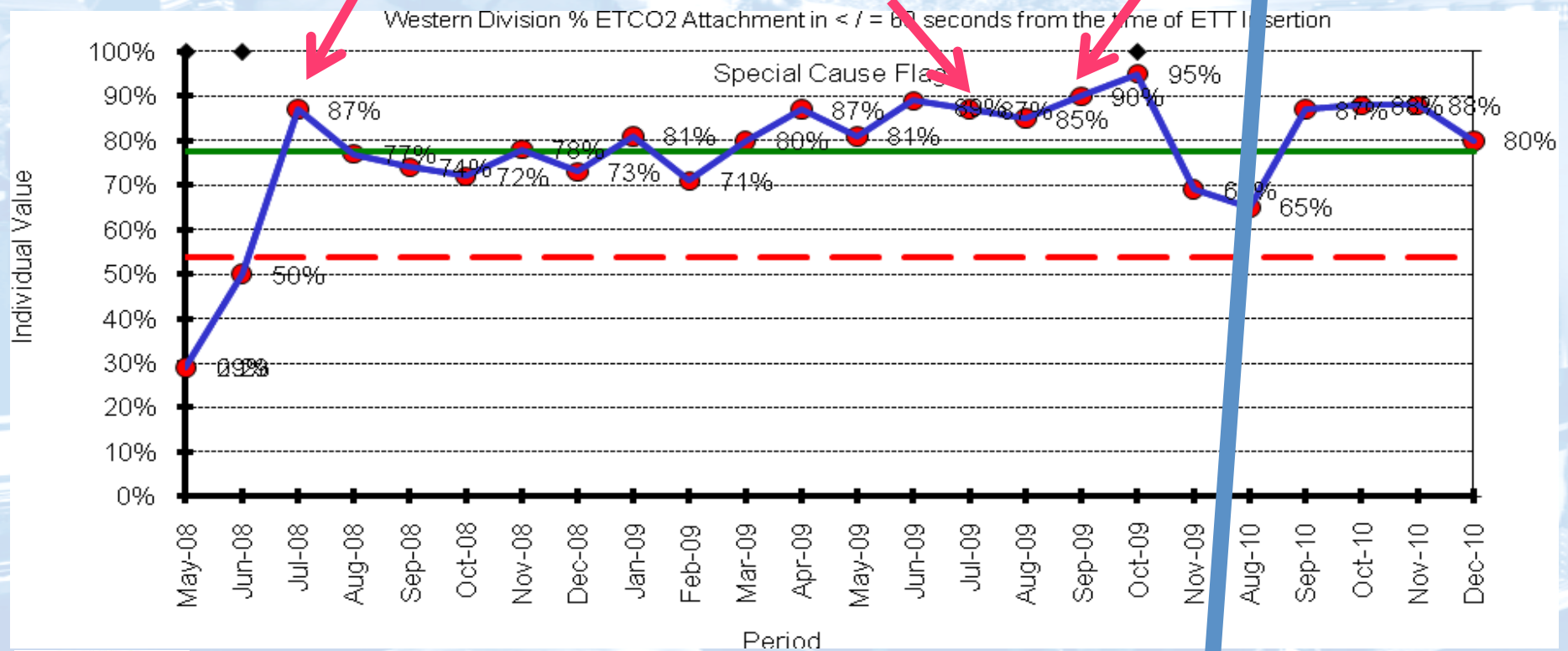


OKC EtCO₂ ≤ 60 secs post intubation

MEMO

PROTOCOL

30 DAY SUSPENSIONS

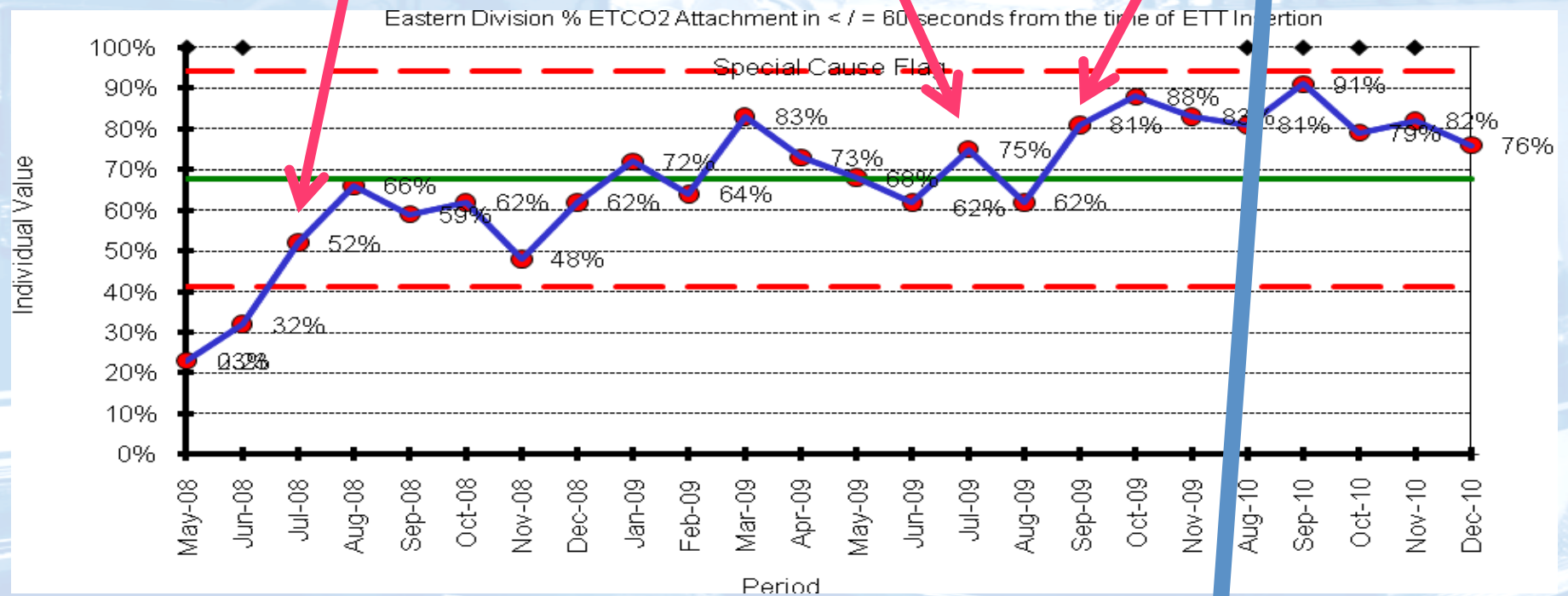


Tulsa EtCO₂ ≤ 60 secs post intubation

MEMO

PROTOCOL

30 DAY SUSPENSIONS

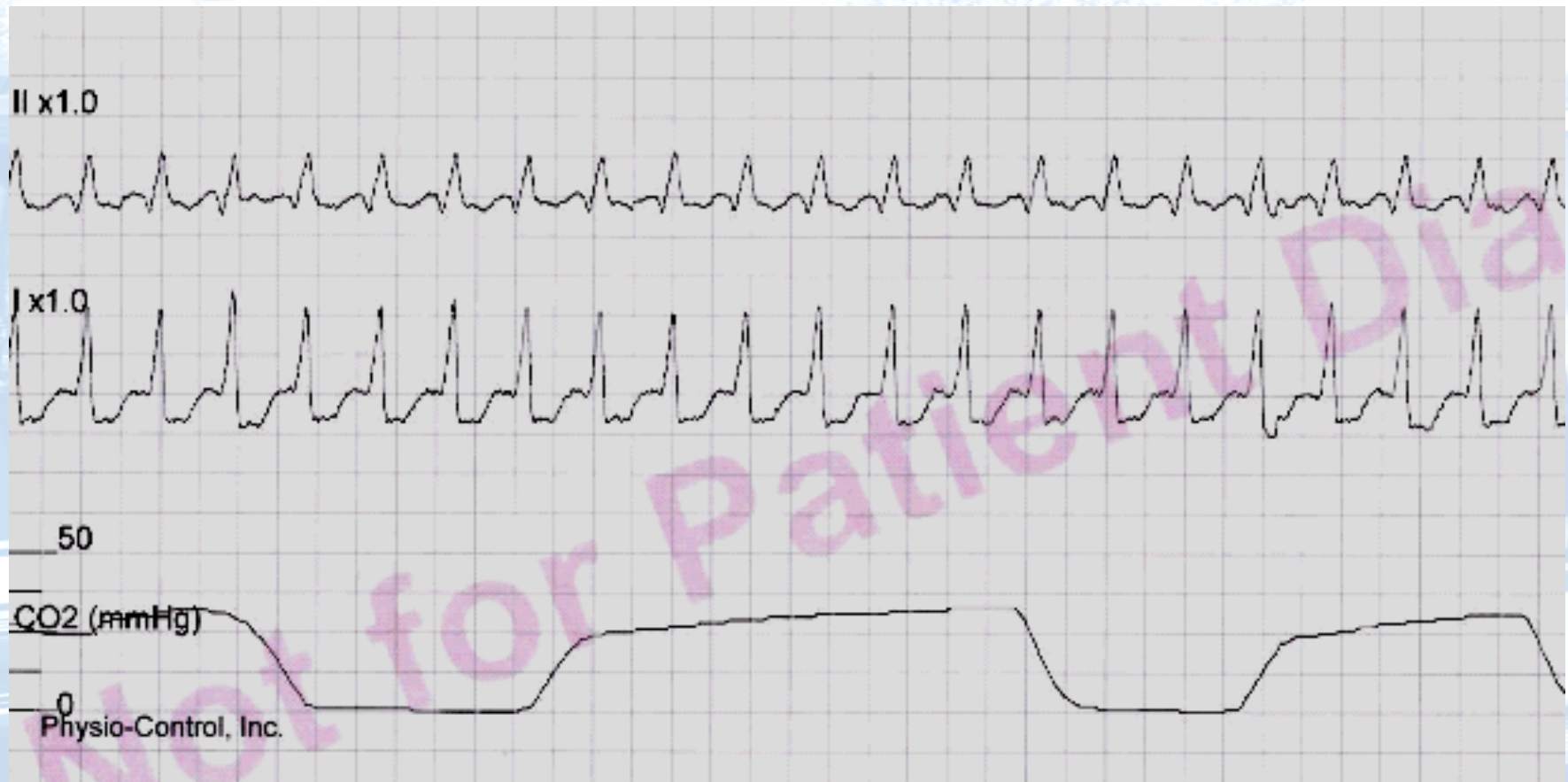


Airway Management Advances

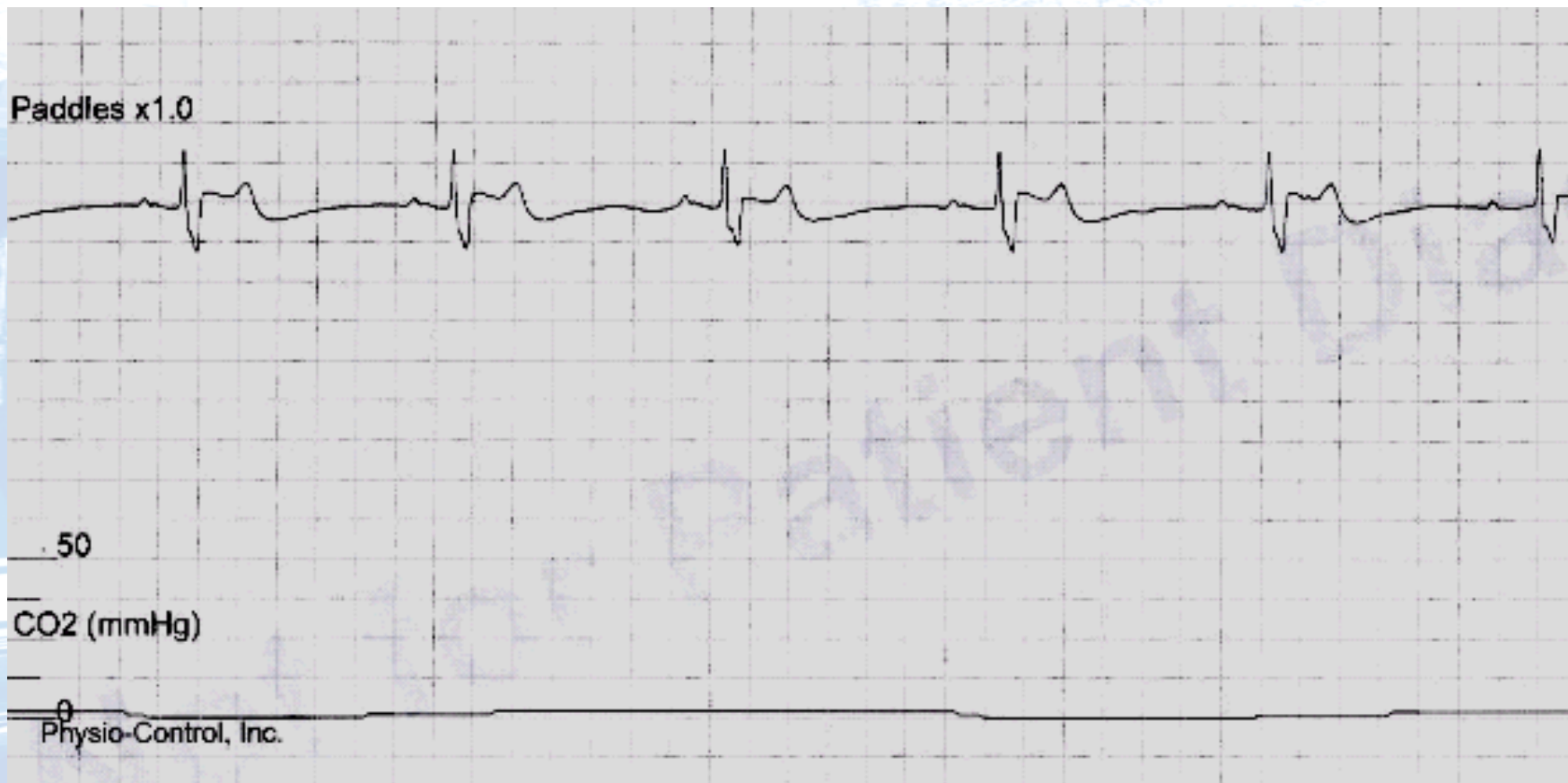
- **Emphasis on Oxygenation & Ventilation**
 - Typical month 3-5 extubations in the field
- **Vanishing “equipment failure” cases**
 - Tested 250+ LP12s in OKC & Tulsa (99.5%+ pass rate)
- **New Airway**
 - King LT-D has replaced Combitube
 - No mandate to use capnography to confirm (still encouraged for vent assessment)



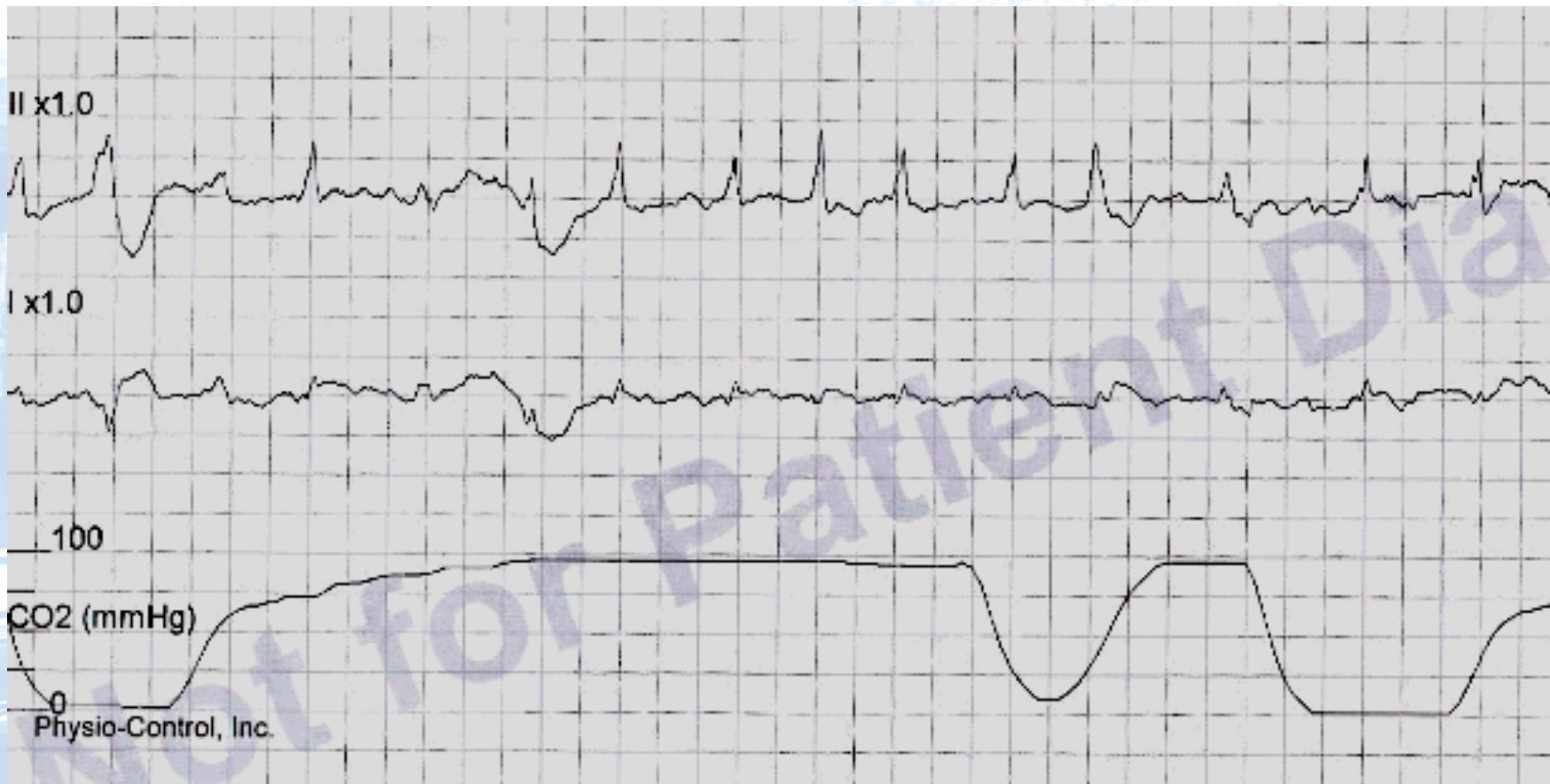
Extubate? EtCO₂ = “35”



Extubate? EtCO₂ = “---”



Troubleshoot this...EtCO₂ = “---”



Capnography – Quantitative Perfection?

The Utility of Early End-Tidal Capnography in Monitoring Ventilation Status After Severe Injury

Keir J. Warner, BS, Joseph Cuschieri, MD, Brandon Garland, BS, David Carlbom, MD, David Baker, MD, Michael K. Copass, MD, Gregory J. Jurkovich, MD, and Eileen M. Bulger, MD

“Patients ventilated in the recommended EtCO₂ (range, 35-40) were likely to be under ventilated (PaCO₂ >40 mmHg) **80%** of the time, and severely under ventilated (PaCO₂ > 50 mmHg) **30%** of the time”

J Trauma 2009;66:26-31



CONCLUSION

Linear regression demonstrates that expired CO_2 levels as measured by EtCO_2 are poorly correlated to arterial partial pressure of CO_2 in the trauma patient. Its use as a noninvasive monitor to target ventilation may be misleading. Targeting an EtCO_2 range of 30 to 35 or 35 to 40 mm Hg may lead to inadvertent hypercapnea.

Where do we go from here?

Is this reproducible in severe trauma?

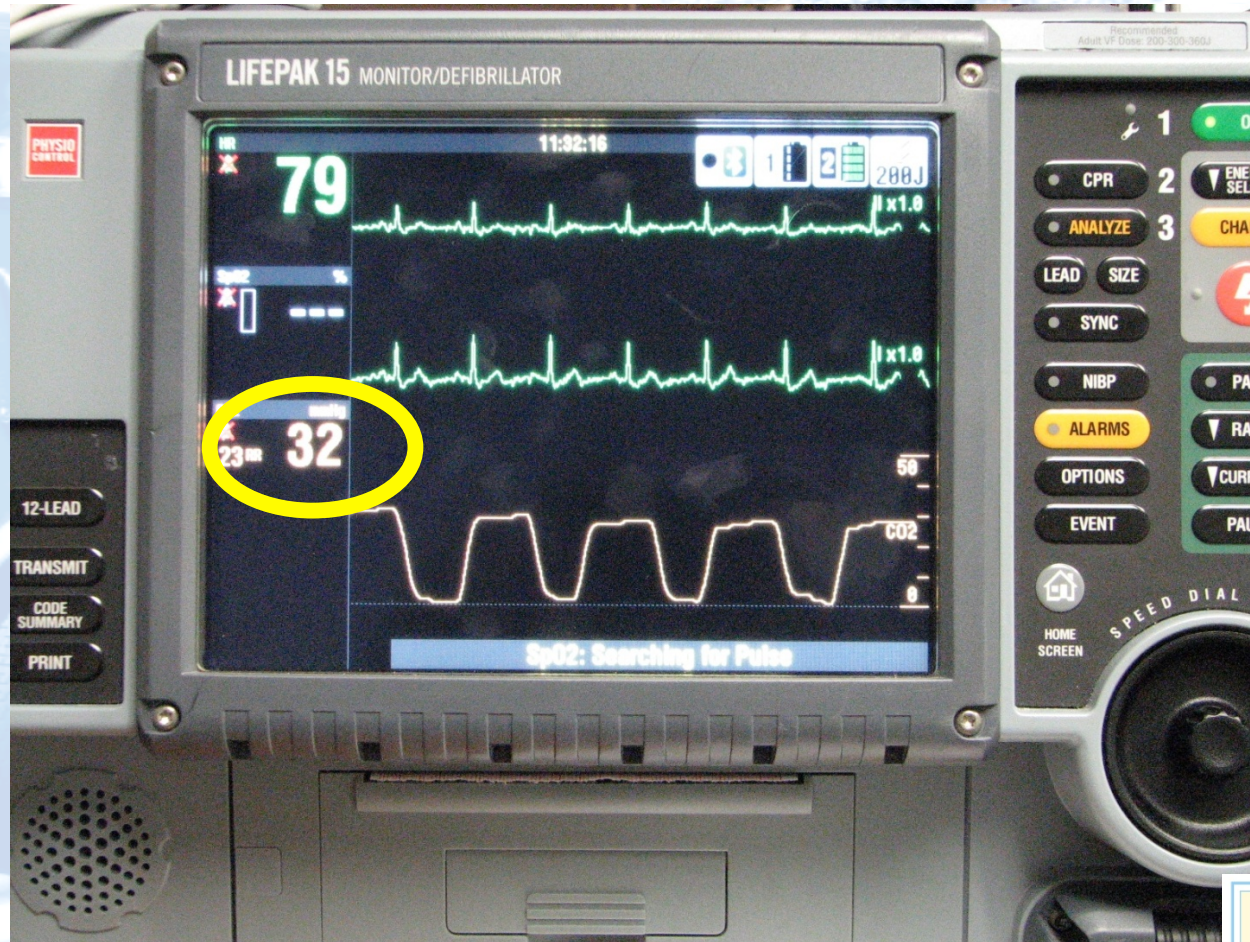
What about medical patients?

What about pediatrics?

Do we reset EtCO_2 goals to 25 to 30mmHg?



Waves Not Just Numbers...



The background of the slide is a blurred image of emergency lights, likely from a police or ambulance, with red and blue lights creating a bokeh effect.

Primum Non Nocere

Translations:

1 – It's about oxygenation & ventilation, not intubation.

2 - The whole life of an ET tube in use in the “goose” had best be seconds.

Safe Intubation in 2011

Continuous Waveform EtCO₂ Summary

- OBJECTIVE confirmation
- NOT risk management – It IS proper patient assessment, care, and safety
- Using it all the time is good
- Using it timely all the time is better
- *The standard of care for confirmation of correct endotracheal intubation placement*







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