Monitoreo en sedacion y anestesia general
Complicaciones mas comunes

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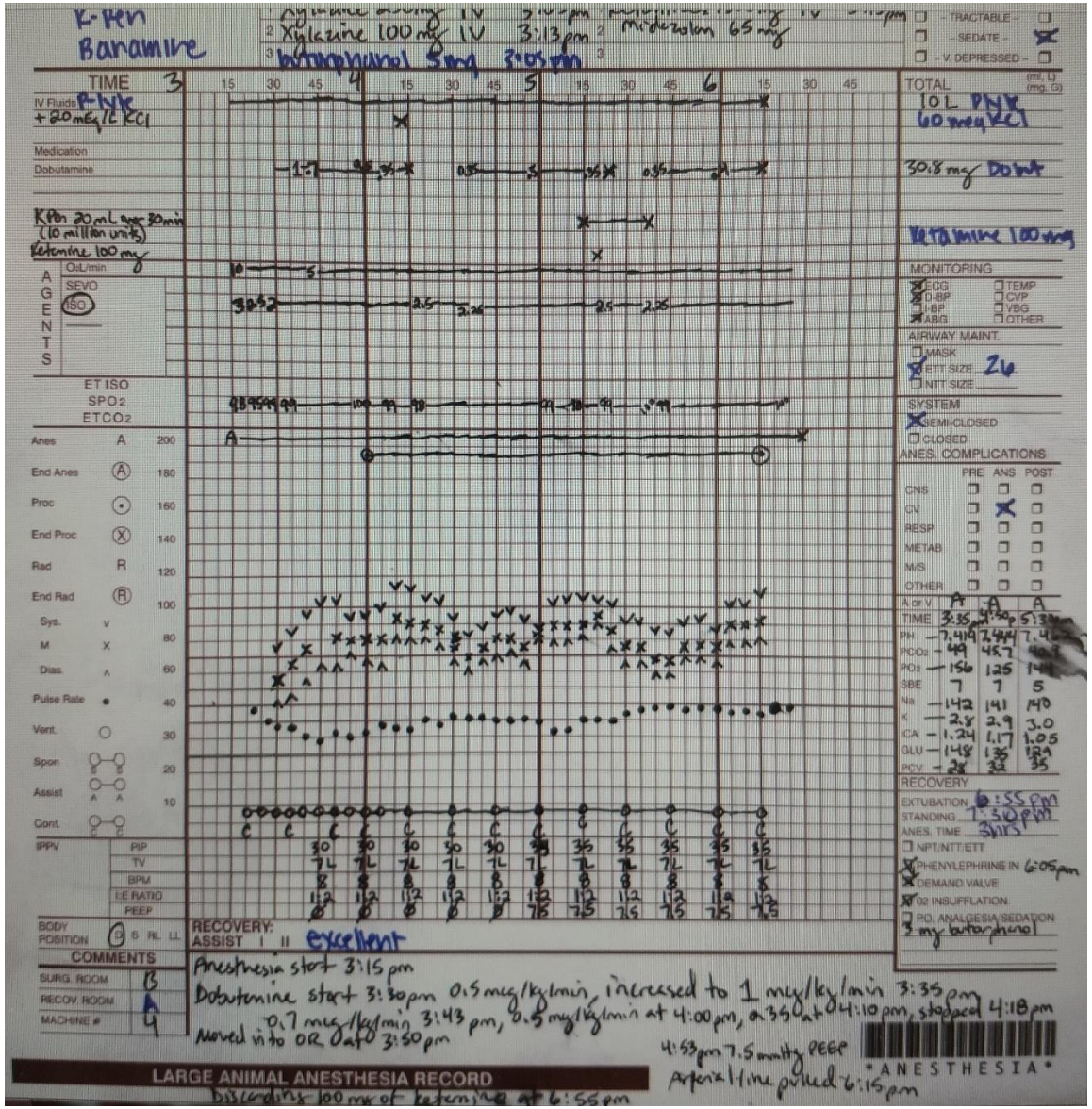

K-Ket
Baramine
2 Xylazine 100 mg IV 3:13 pm
3 butorphanol 5mg 3:05 pm
2 midazolam 65 mg IV
TRACTABLE
SEDATE
V. DEPRESSED
TIME
IV Fluids PLR
+ 20 meq/L KCl
Medication
Dobutamine
K-Ket 20 mL over 30 min
(10 million units)
Ketamine 100 mg
AGENTS
O2L/min
SEVO
ISO
ET ISO
SPO2
ETCO2
Anes A
End Anes
Proc
End Proc
Rad R
End Rad
Sys.
M
Dias.
Pulse Rate
Vent.
Spon
Assist
Cont.
IPPV
PIP
TV
BPM
I:E RATIO
PEEP
BODY POSITION
COMMENTS
SURG. ROOM B
RECOV. ROOM A
MACHINE # 4
RECOVERY:
ASSIST I II excellent
TOTAL
1 L PLR
60 meq KCl
30.8 mg Dobut
Ketamine 100 mg
MONITORING
ECG
NI-BP
I-BP
ABG
TEMP
CVP
VBG
OTHER
AIRWAY MAINT.
MASK
ETT SIZE 26
NTT SIZE
SYSTEM
SEMI-CLOSED
CLOSED
ANES. COMPLICATIONS
PRE ANS POST
CNS
CV
RESP
META.B.
M/S
OTHER
A or V
TIME 3:35 5:30 5:35
PH 7.419 7.444 7.4
PCO2 49 45.7
PO2 156 125
SBE 7 7 5
Na 142 141 140
K 2.8 2.9 3.0
iCA 1.24 1.17 1.05
GLU 148 135 189
PCV 28 33 35
RECOVERY
EXTUBATION 6:55 pm
STANDING 7:50 pm
ANES. TIME 3hrs
NPT/NTT/ETT
PHENYLEPHRINE IN 6:05 pm
DEMAND VALVE
O2 INSUFFLATION
PO. ANALGESIA/SEDATION
3 mg butorphenol
Anesthesia start 3:15 pm
Dobutamine start 3:30 pm 0.5 mcg/kg/min, increased to 1 mcg/kg/min 3:35 pm
Moved into OR at 3:50 pm 0.7 mcg/kg/min 3:43 pm, 0.5 mg/kg/min at 4:00 pm, at 3:50 at 4:10 pm, stopped 4:18 pm
4:53 pm 7.5 cm H2O PEEP
Arterial line pulled 6:15 pm
ANESTHESIA
LARGE ANIMAL ANESTHESIA RECORD
Discard 100 mL of ketamine at 6:55 pm

Procedimientos bajo sedacion

Examen fisico y **muestras** de sangre en animales **agresivos**

Imagenologia (radiologia, U/S y TAC)

Bloqueos de nervios y **epidurales** en dolor cronico o agudo

Curacion de heridas, vendajes, etc

Protocolos de sedacion

En animales **sin cardiopatia**, enfermedad respiratoria o neurologica

Dexmedetomidina 2-3 mcg/kg + butorfanol 0.1-.02 mg/kg IV o IM

Adiciones: 1-2 mcg/kg dexmed IV

+/- propofol 0.5-1 mg/kg bolo IV

O KETOFOL

Protocolos de sedacion

Ketofol (ketamina + propofol 1:1 en mg)

- 1 parte Ketamina 100 mg/ml mas 9 partes propofol 10 mg/ml
- Mezclado en la misma jeringa
- 0.5-1 mg/kg IV, adiciones a efecto

Hipoventilacion, hypoxia y apnea

Todos los protocolos de sedacion que **inmobilizan** al paciente **pueden** resultar en **hipoventilacion** e **hipoxia**

Sobre todo si incluyen opioides, propofol o ketamina

Aun en animales con buena funcion cardiaca y respiratoria

Hipoventilacion, hipoxia y apnea

Hipoventilacion es **generalmente tolerada**

Hipoxia por **desplazamiento** de **O_2**

Normoventilacion

$PAO_2 = FiO_2 (P_{atm} - P_{H2O}) - PCO_2/0.8$

$PAO_{2=}$ 0.21 (760-47) – 40/0.8 = ***100 mmHg***

Hipoventilacion

$PAO_{2=}$ 0.21 (760-47) – **60**/0.8 = ***75 mmHg***

Hipoventilacion, hypoxia y apnea

Solo por **hipoventilar** puede haber hipoxia (PaO_2 <85 mmHg)

No incluye:

Enfermedad pulmonar

Shunt pulmonary (ocurre durante anestesia en sanos, y mas en gerontes/obesos)

Obstruccion de vias aereas

Hipoventilacion, hipoxia y apnea

Tratamiento: **O_2**

$PAO_{2=}$ ***0.4*** (760-47) – **60**/0.8 = ***210 mmHg***

Mascara o sondas nasals

Solo contraindicado en incendios

Hipoxemia durante la anesthesia general

En sanos asociado a **shunt pulmonar**

Shunt es multifactorial, pero afectado por **reduccion** del **volumen pulmonar**

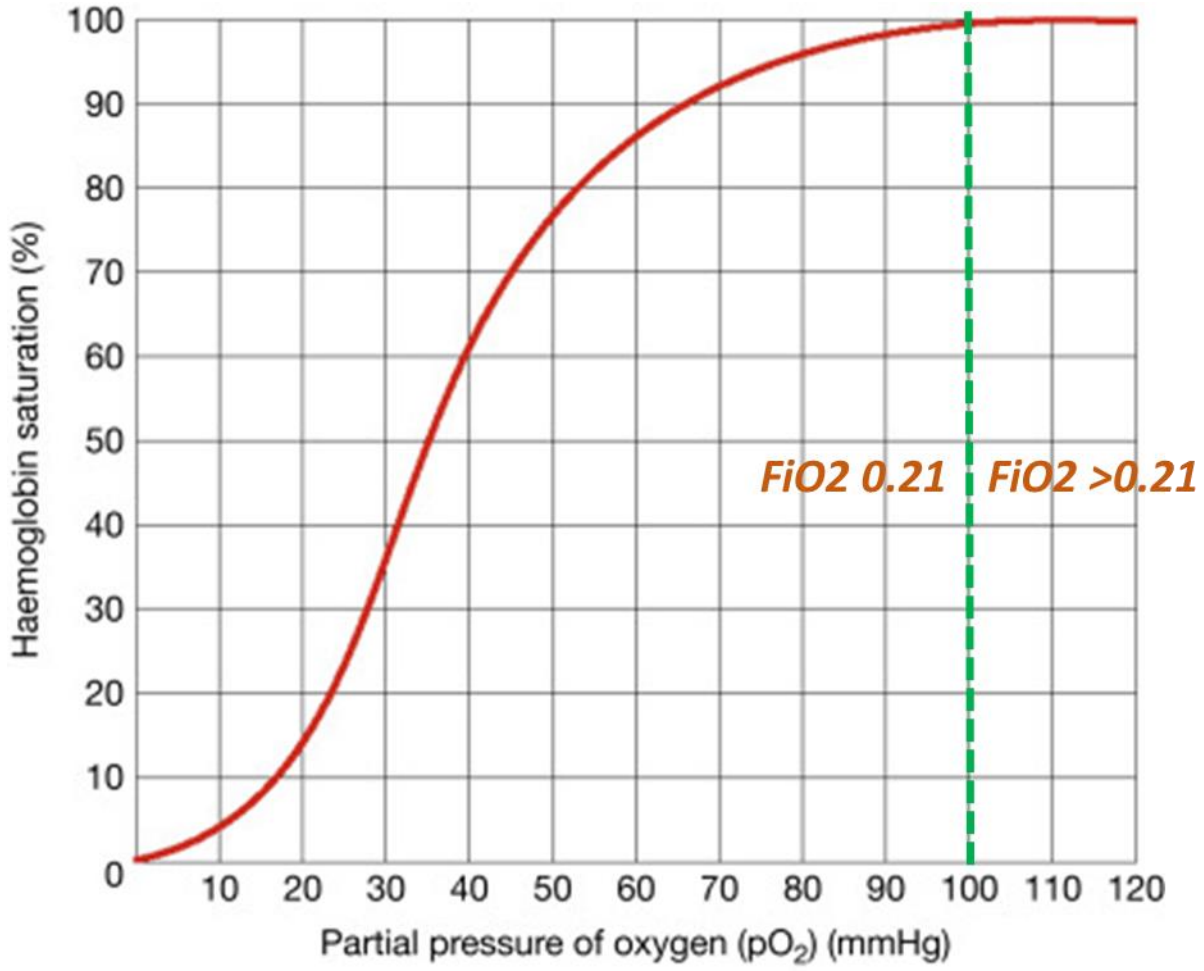
Volumen pulmonar aftectado por decubito, tiempo, presion intra-abdominal, obesidad

Diagnostico de la hipoxemia – oximetria de pulso

La **oximetria** de pulso mide la **saturacion** de **hemoglobina**

La **caida** de **SpO2** con FiO2 **100**% revela una **falla grave**

Reducciones leves de oxigenacion solo se detectan con **gases arteriales**



https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/oxygen-hemoglobin-dissociation-curve

Estrategias para prevenir (o reducir) shunt

Ventilacion espontanea: **actividad diafragmatica** previene cierto grado de colapso

Reclutamiento alveolar: objetivo es abrir alveolos colapsados

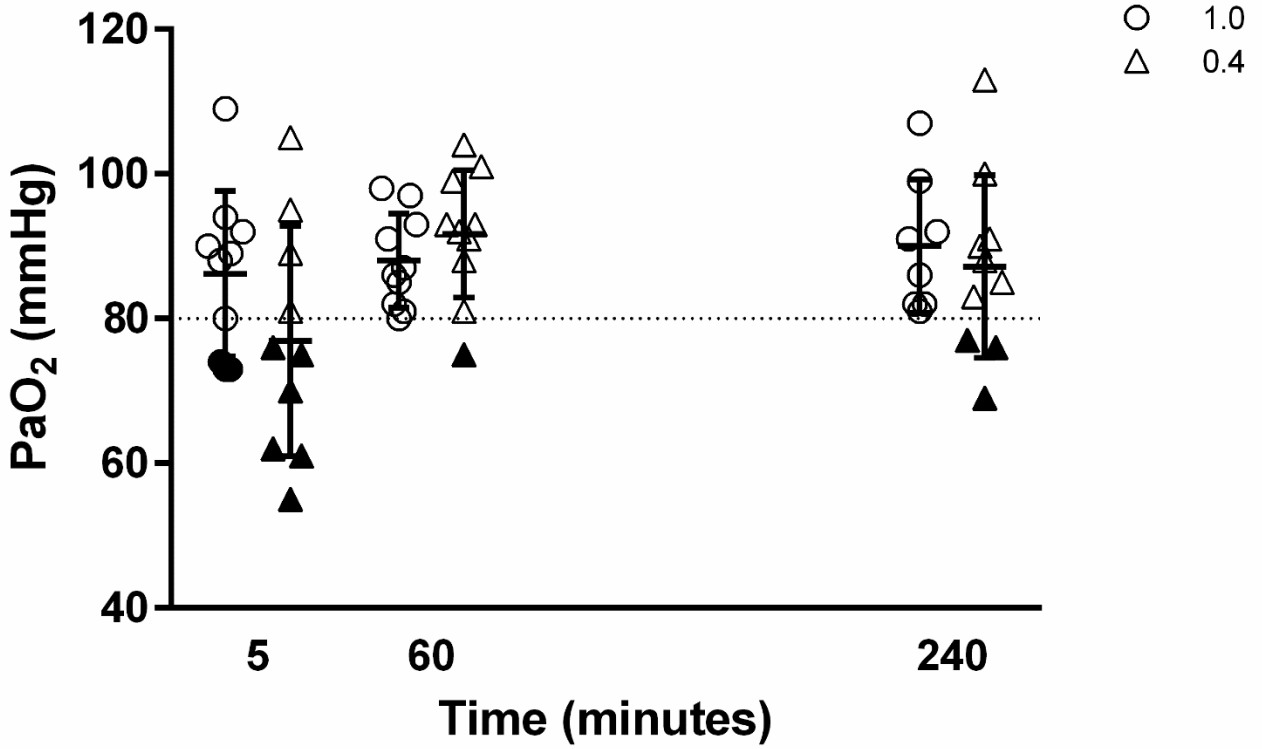
- Efectos de **corta duracion** – deberia ser seguido de PEEP o CPAP
- O **repetidas periodicamente**

Reduccion de la FiO_2?

Reduccion de la FiO2

Effects of two fractions of inspired oxygen during anesthesia on early postanesthesia oxygenation in healthy dogs

tion. Hypoxemia (Pao_2 < 80 mm Hg) was diagnosed in 1 dog in the control group (Pao_2 = 74 mm Hg) and 1 dog in the 40% oxygen group (Pao_2 = 76 mm Hg) at 5 minutes after extubation, and in another dog in the control group (Pao_2 = 79 mm Hg) at 20 minutes



Cuidado con “adoptar” esta practica en forma **indiscriminada**

El **riesgo** de hipoxia **sube**

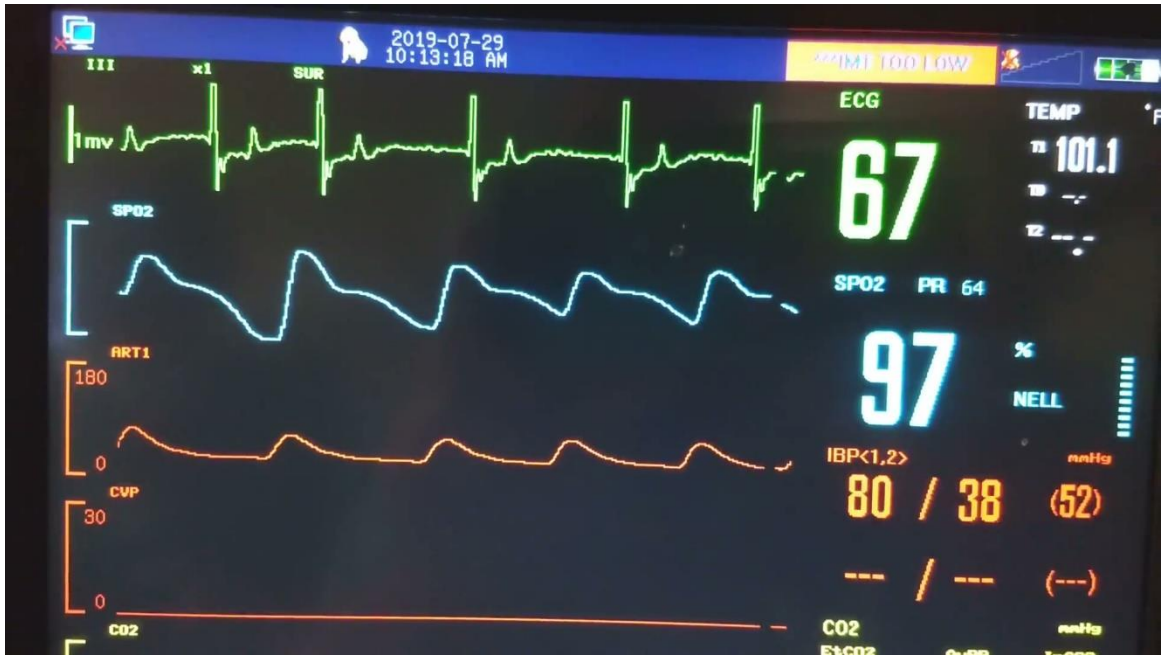
El **tiempo** tolerable de **apnea baja**

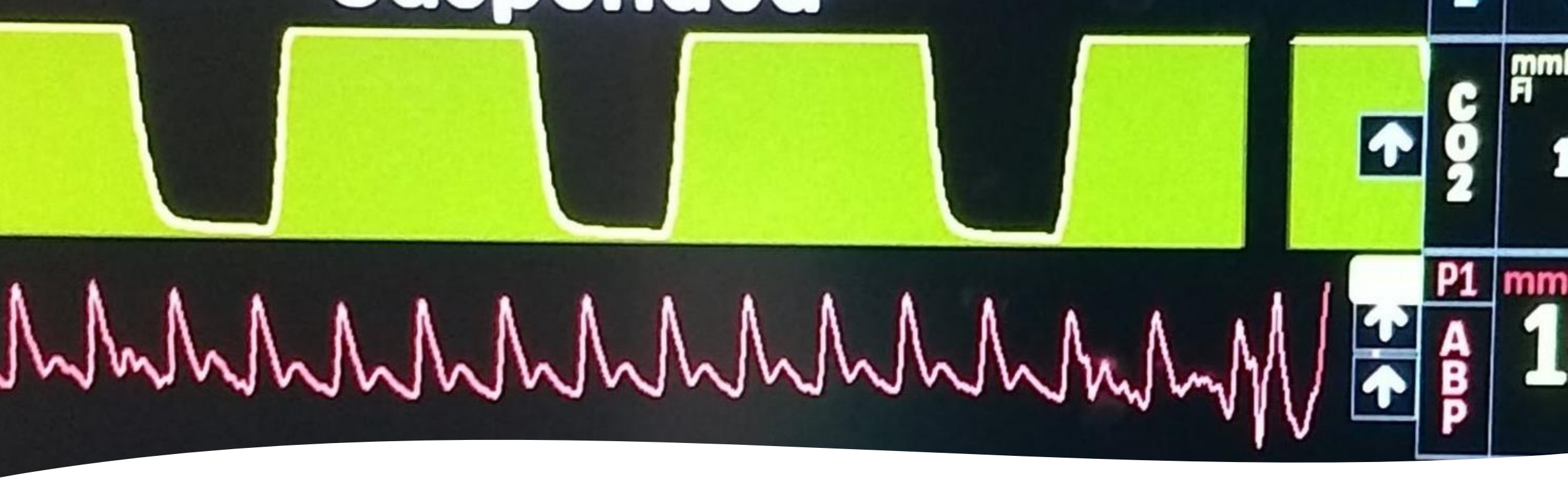
Posiblemente poco util si hay cierre de vias bajas

La literature es inconclusa en cuanto a ventajas

Otros usos del oximetro de pulso – variacion del pulso y perfusion

Cuidado con usar la lectura de la curva pletismografica para evaluar presion arterial o perfusion





Capnografia

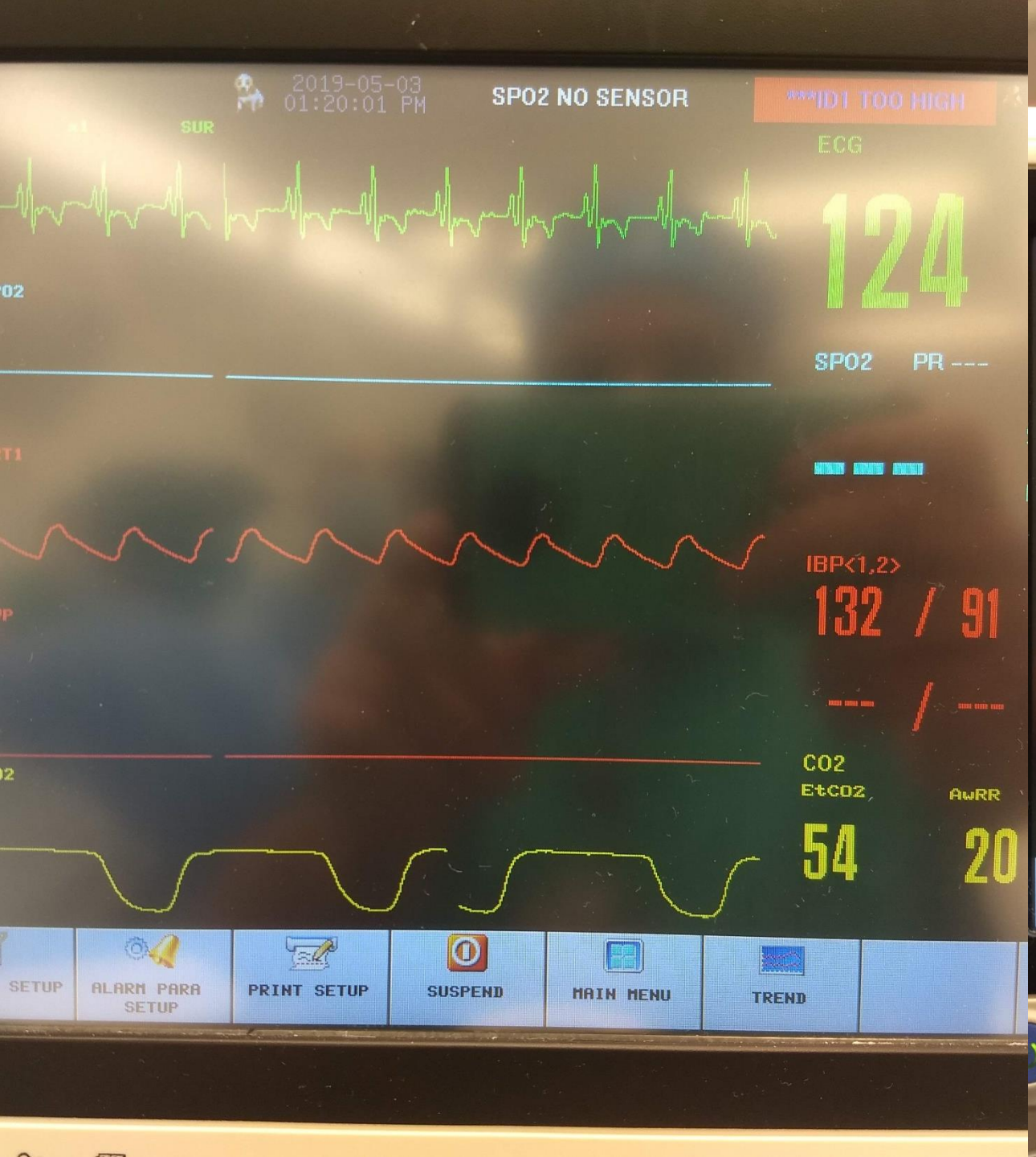
Evalua la ventilacion **espontanea**

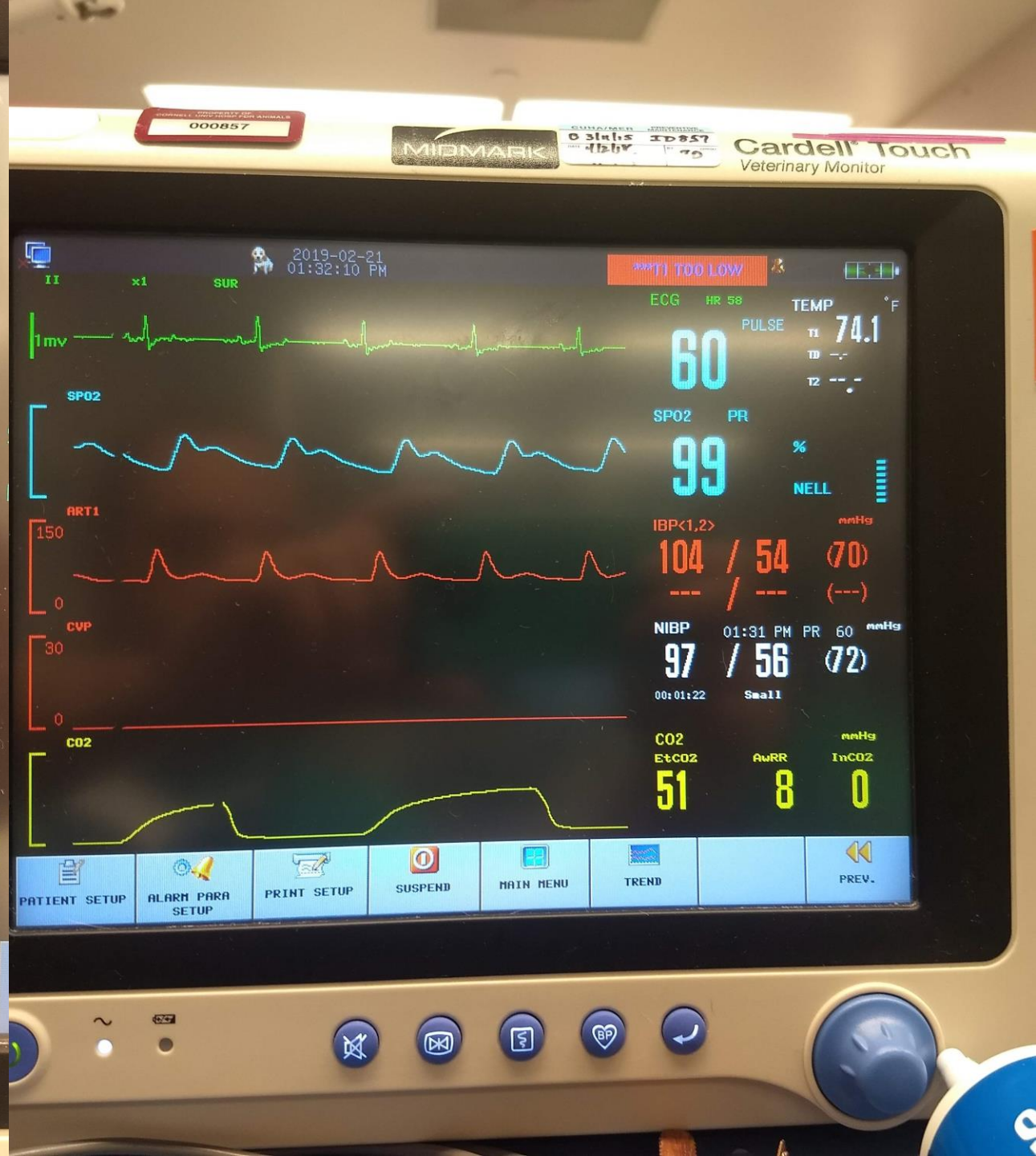
Guia la ventilacion **mecanica**

Evidencia de **via aerea permeable**

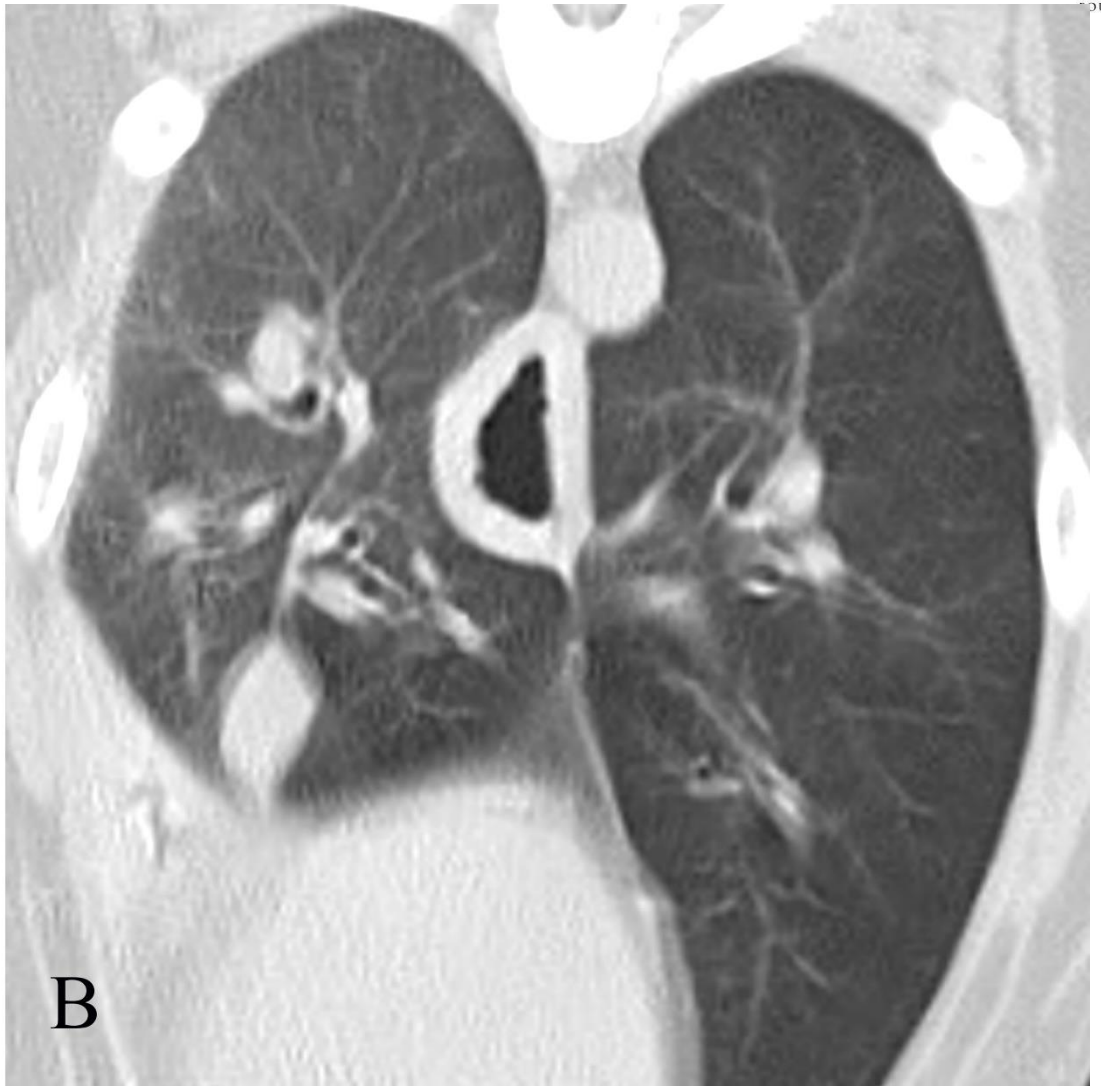
Ausencia de CO_2 expirado indica **obstruccion** de la via, **apnea**, o **perdida** de **GC**

Cambios en la **morfologia** pueden indicar **obstrucciones**

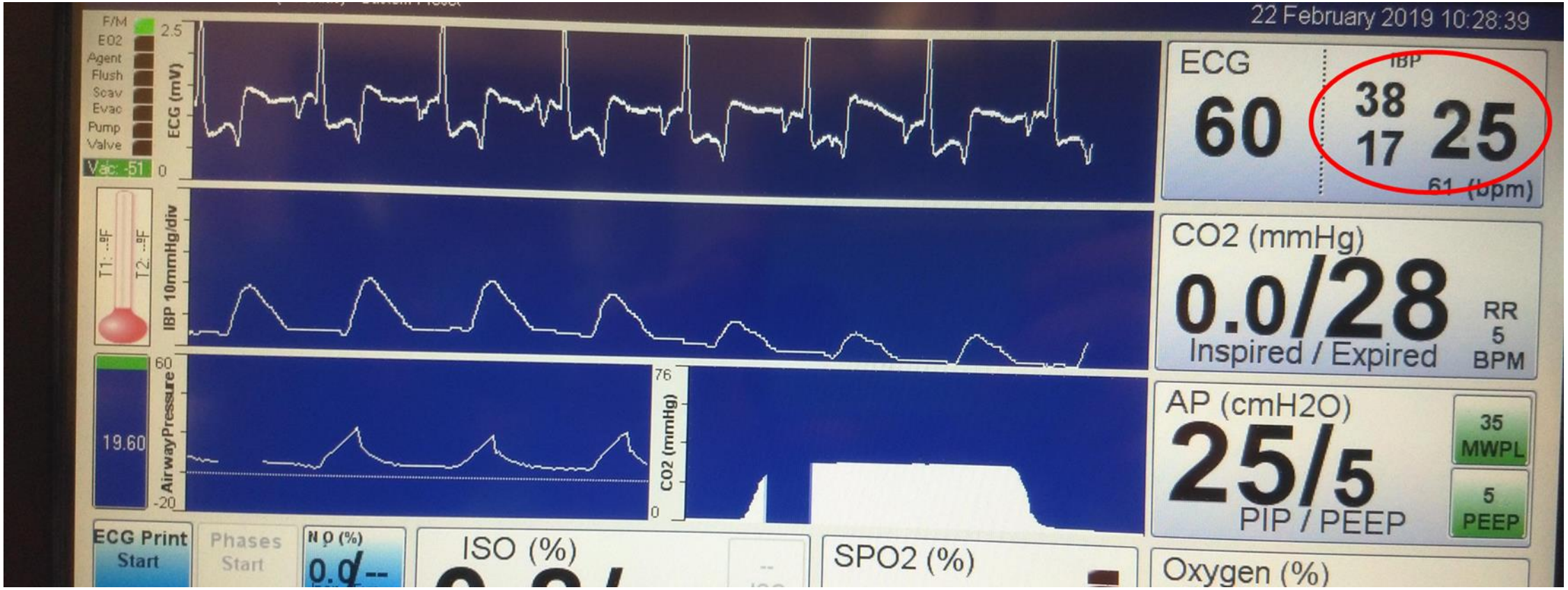

2019-05-03
01:20:01 PM
SPO2 NO SENSOR
***ID1 TOO HIGH
SUR
ECG
124
SPO2
PR ---
IBP<1,2>
132 / 91
--- / ---
CO2
EtCO2
AwRR
54
20
SETUP
ALARM PARA SETUP
PRINT SETUP
SUSPEND
MAIN MENU
TREND


000857
MIDMARK
Cardell Touch
Veterinary Monitor
2019-02-21
01:32:10 PM
***T1 TOO LOW
II
x1
SUR
ECG
HR 58
1mv
PULSE
60
TEMP °F
T1 74.1
T2
SPO2
SPO2
PR
99
%
NELL
ART1
150
0
IBP<1,2>
mmHg
104 / 54 (70)
--- / --- (---)
CVP
30
0
NIBP
01:31 PM PR 60
mmHg
97 / 56 (72)
00:01:22
Small
CO2
mmHg
EtCO2
AwRR
InCO2
51
8
0
PATIENT SETUP
ALARM PARA SETUP
PRINT SETUP
SUSPEND
MAIN MENU
TREND
PREV.


A


B

Hipotension arterial

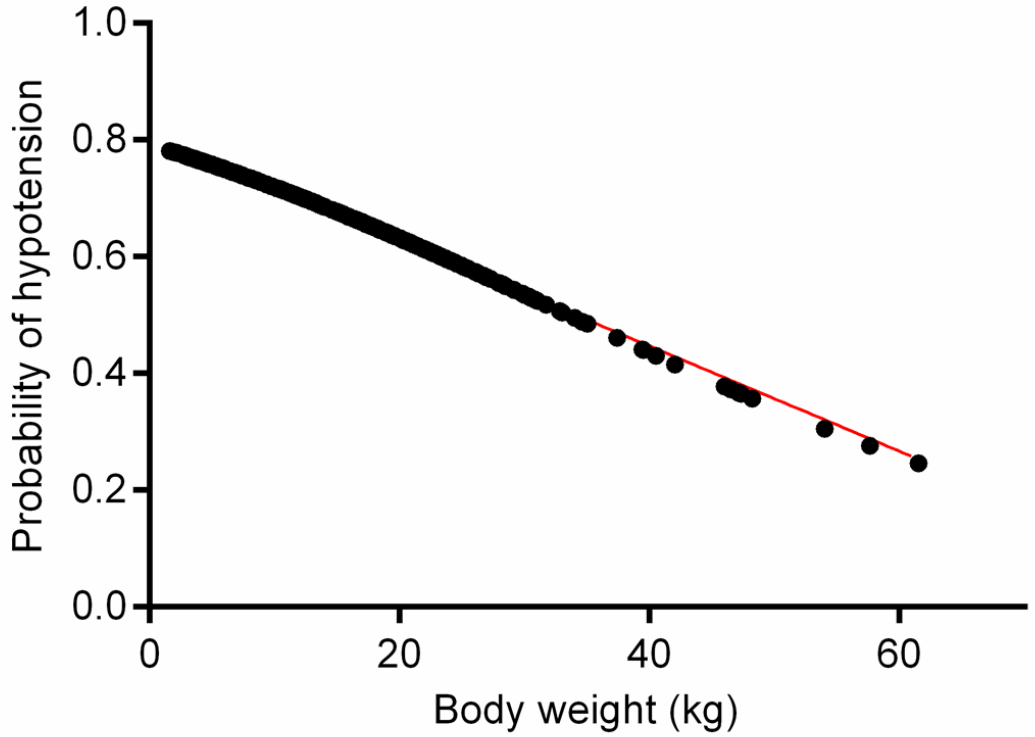


Hipotension durante anestesia

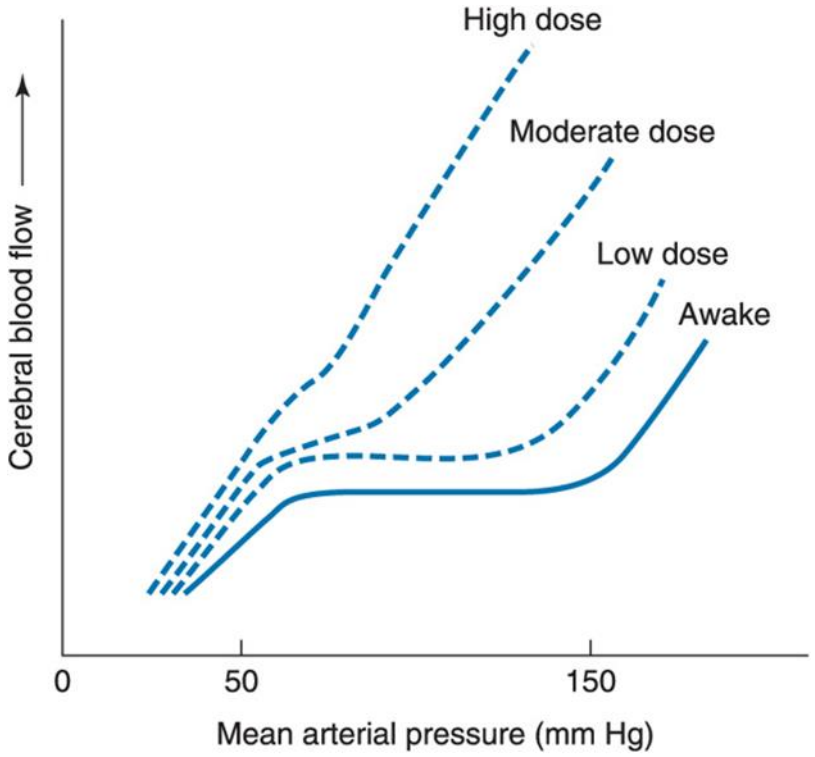
Investigation of associations between preoperative acepromazine or dexmedetomidine administration and development of arterial hypotension or bradycardia in dogs undergoing ovariohysterectomy

The prevalence of arterial hypotension was 110 of 149 (74%) and 106 of 192 (55%) for dogs that received acepromazine and dexmedetomidine, respectively ($P < 0.001$). Body weight was significantly ($P < 0.001$) and negatively correlated with the probability of hypotension ($R^2 = 0.99$; **Figure 1**). The odds of hypotension were significantly ($P < 0.001$) greater for dogs sedated with acepromazine (OR, 2.61; 95% CI, 1.61 to 4.23) than for dogs sedated with dexmedetomidine. No significant association was found between any other evaluated factor and development of hypotension.

The incidence of bradycardia was 86 of 149 (58%) for dogs sedated with acepromazine and 154 of 192 (80%) for those sedated with dexmedetomidine ($P < 0.001$). The odds of bradycardia were significantly ($P = 0.002$) greater for dogs that received dexmedetomidine (OR, 2.45; 95% CI, 1.4 to 4.27) than for dogs



Hipotension arterial



https://aneskey.com/neurophysiology-and-anesthesia/

Complicacion mas comun en nuestro servicio (antes era hipotermia)

Autorregulacion – flujo **depende de presion** con PAM **< 60** mmHg

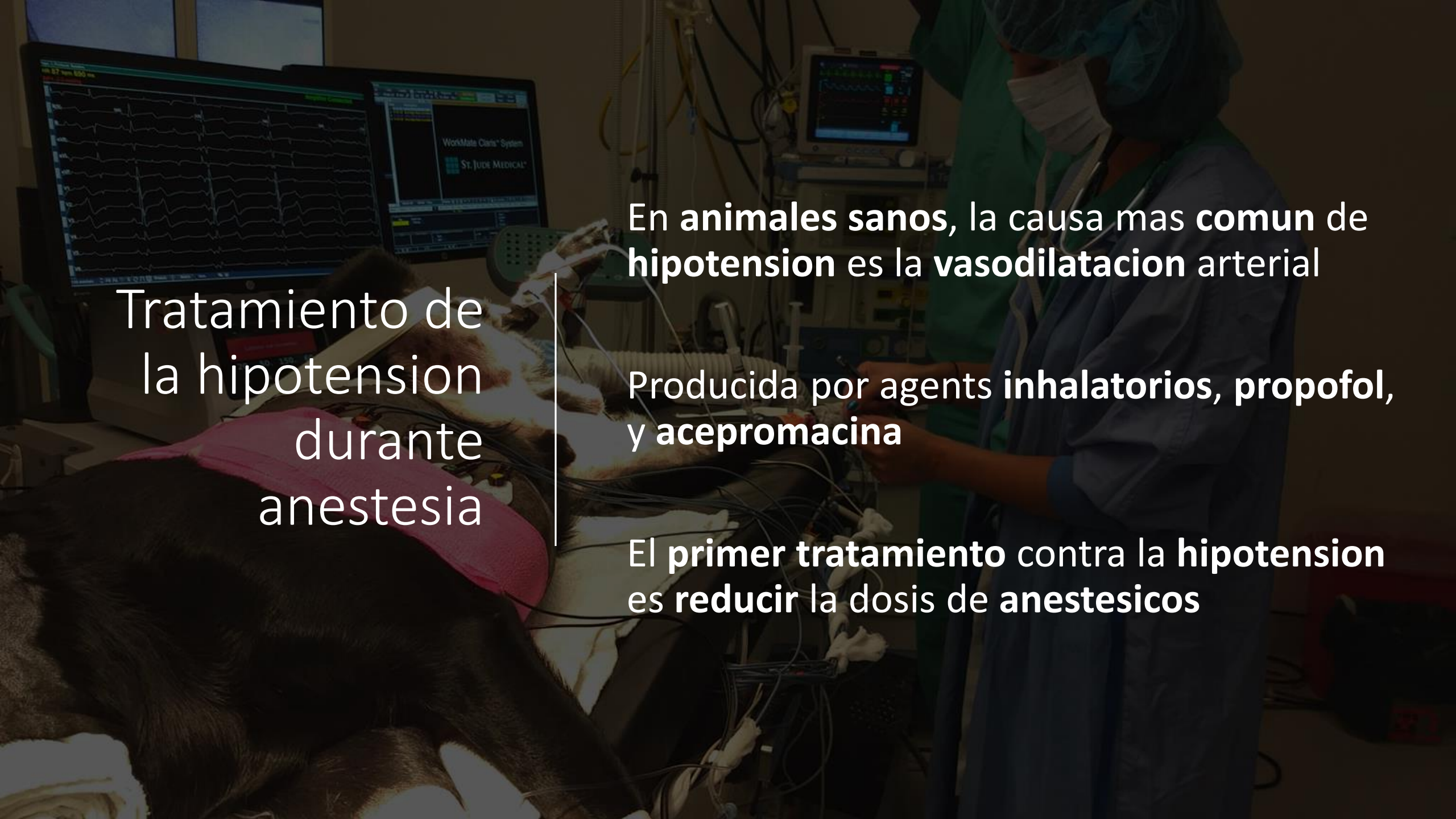
Diferentes causas: **hipovolemia**, bajo **inotropismo**, bradicardia, **vasodilatacion**

Tratamiento de la hipotension

La causa mas comun de hipotension en **perros sanos** durante la **anestesia inhalatoria** es la **vasodilatacion**

Bajo inotropismo e hipovolemia son menos communes

Es **muy dificil reconocer** la **causa principal** de hipotension con monitorizacion corriente



Tratamiento de la hipotension durante anestesia

En **animales sanos**, la causa mas **comun** de **hipotension** es la **vasodilatacion** arterial

Producida por agents **inhalatorios**, **propofol**, y **acepromacina**

El **primer tratamiento** contra la **hipotension** es **reducir** la dosis de **anestesicos**

Estrategias para reducir anestesicos

Adyuvantes

- Opioides
- Ketamina
- Dexmedetomidina

BNM

Anestesia regional

Tratamiento farmacologico - vasopresores

En **humanos** el tx **mas comun es usar vasoconstrictors.** En **veterinaria, inotropicos**

Fenilefrina es el vasopresor mas comun en humanos y en USA

Agonista α1 – actua directamente sobre la vasculatura

Hidrosoluble, rapido metabolism y corta duracion

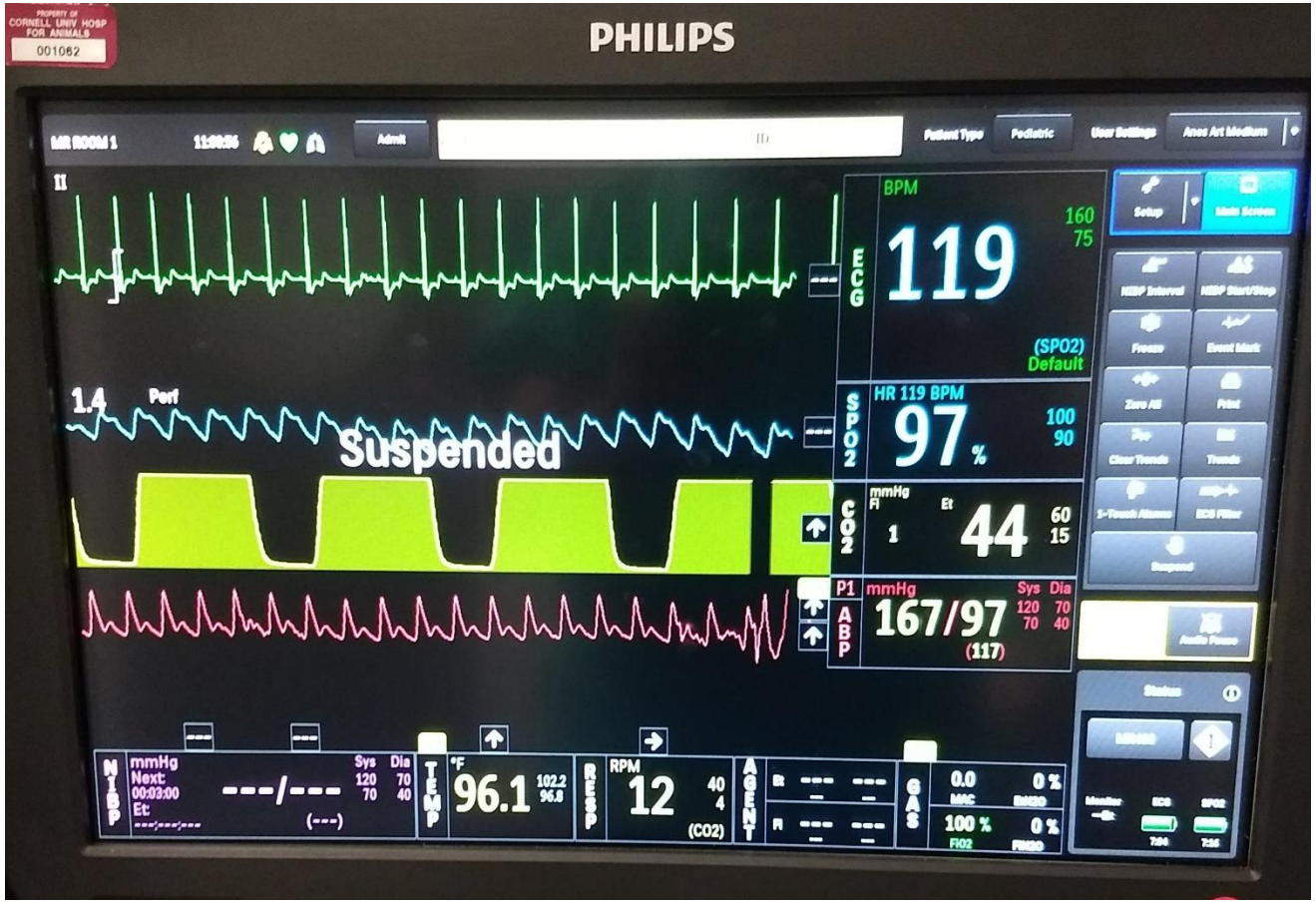
Tratamiento farmacologico - vasopresores

Fenilefrina

Concentrado: 10 mg/mL

Dosis muy bajas: ~1 mcg/kg IV

Infusion: 0.1-1 mcg/kg/min IV

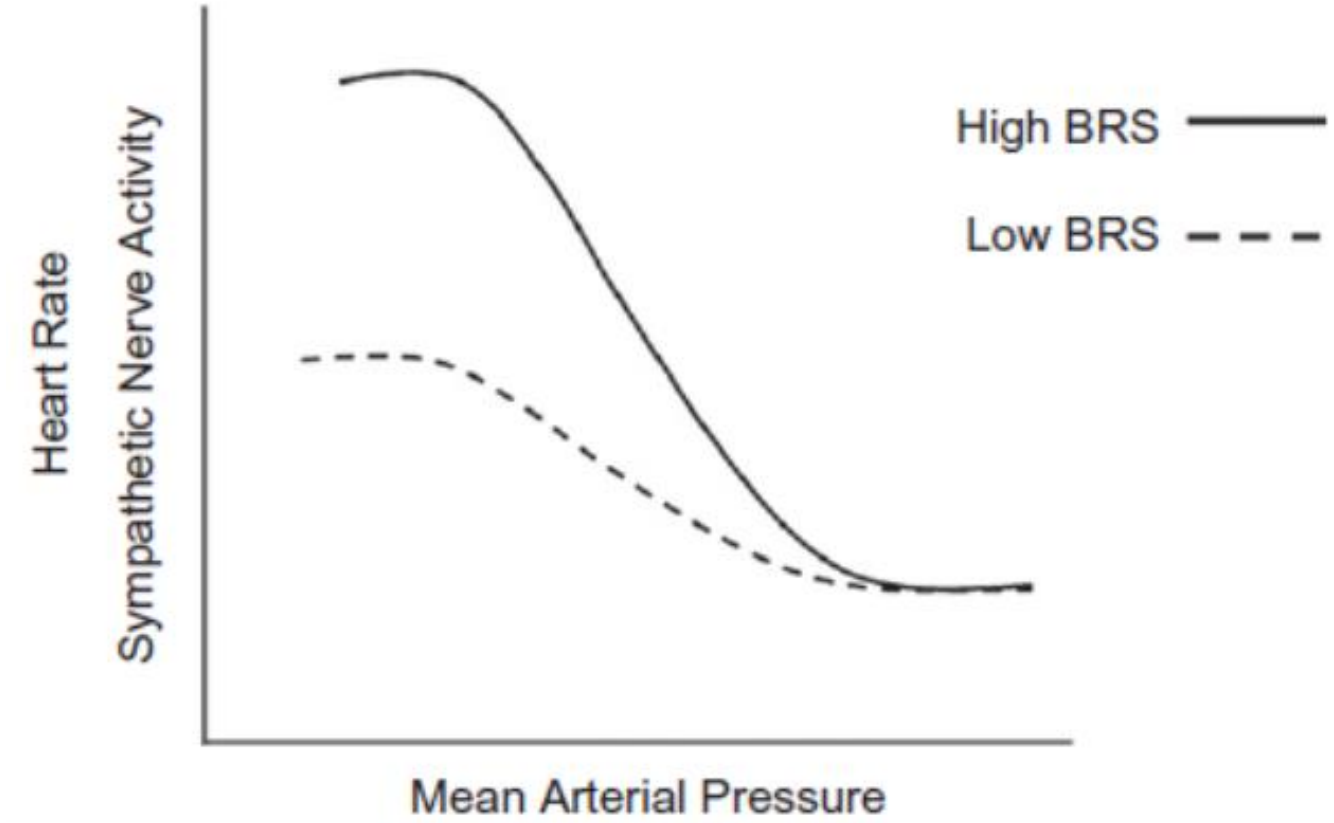


Fenilefrina y FC

Super **eficiente** en subir la PA

Vasoconstriccion produce **bradicardia refleja**

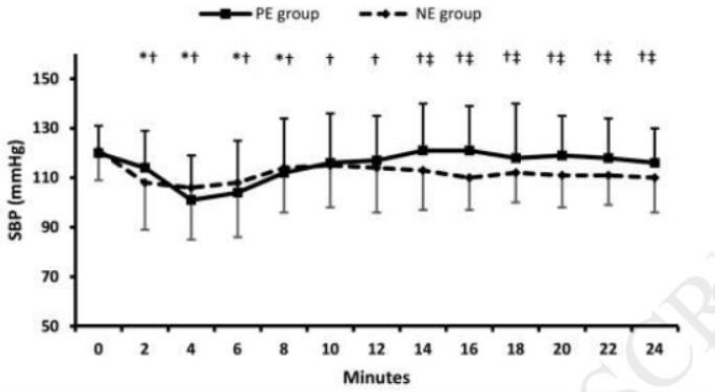
Reflejo baroreceptor - activacion parasimpatica

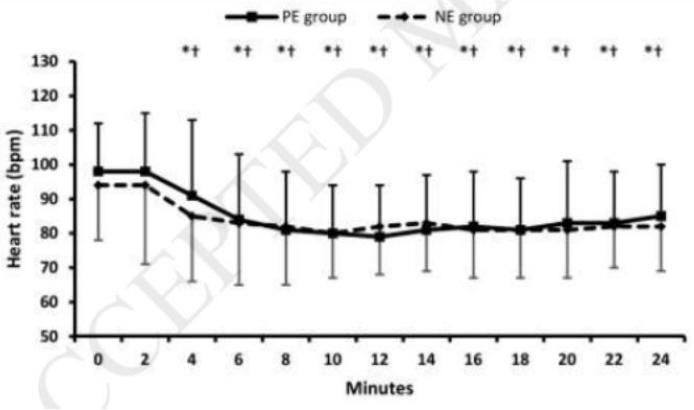


Regulation of blood pressure by the arterial baroreflex and autonomic nervous system

ERICA A. WEHRWEIN[1]* AND MICHAEL J. JOYNER[2]

Fenilefrina vs norepinefrina





Norepinephrine versus phenylephrine infusion for prophylaxis against post-spinal anaesthesia hypotension during elective caesarean delivery: A randomised controlled trial.

Ahmed Hasanin (M.D, D.E.S.A)[a*], Sarah Amin (M.D)[a], Sherin Refaat (M.D)[a], Sara Habib (M.D)[a], Marwa Zayed (M.D)[a], Yaser abdelwahab (M.D)[a], Mohamed Elsayad (M.D)[a], Maha Mostafa (M.D)[a], Heba Raafat (M.D)[a], Ahmed Elshall (M.D)[a], Shimaa Abd El Fatah (M.D)[b]

Methods

A randomised, double-blinded, controlled trial was conducted including mothers scheduled for elective caesarean delivery under spinal anaesthesia. Participants were allocated to two groups: norepinephrine group (n=60), and phenylephrine group (n=63). Participants received prophylactic vasopressors after spinal block at rate started at 0.05 mcg/Kg/min and 0.75 mcg/Kg/min

Inotropicos – dopamina y dobutamina

Dobutamina agonista β1 y debil β2

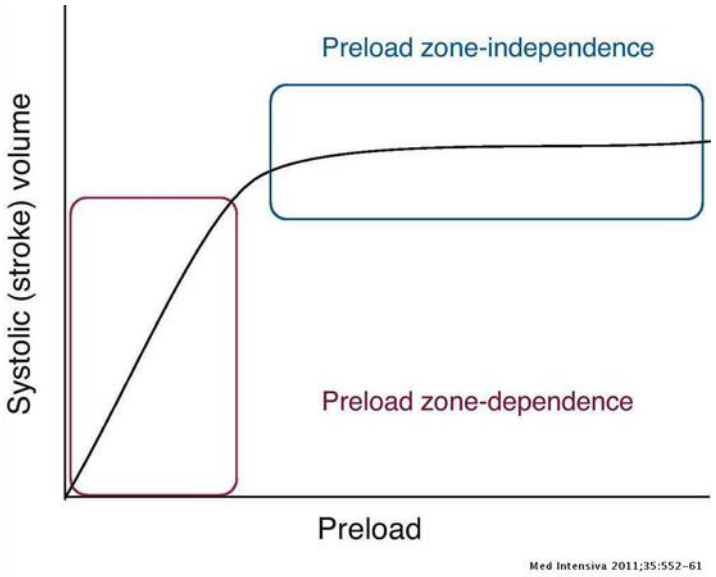
Dopamina agonista D1, β1 y α1 >>> **dosis-dependiente**

Los dos pueden **aumentar** el **GC**, pero **no necesariamente la PA**

An animales **vasodilatados**, pueden resultar en **taquicardia sin aumento de PA** (falta de lleno ventricular)

Uso decreciente en sanos, salvo indicaciones puntuales

Fluidoterapia



http://www.medintensiva.org/en-estimating-cardiac-output-utility-in-articulo-S2173572712000094

Fluidoterapia es **muy comun** en el tratamiento de la hipotension

Su **efectividad** es **generalmente baja**

La fluidoterapia no aumenta el VE, GC, o PA si la precarga ya es optima

Solo funciona en pacientes con precarga baja (**repondedores**)

Como reconocer a “respondedores” (50%)

Muy **dificil** en la **clinica**

Indicadores **dinamicos** (PVI, PPV, SVV)

Aftectados por **factores externos** (ventilacion, tono vascular)

Indicadores **volumetricos** – ecocardio, GC, Doppler esofagico

Menos afectados

Como reconocer a “respondedores”

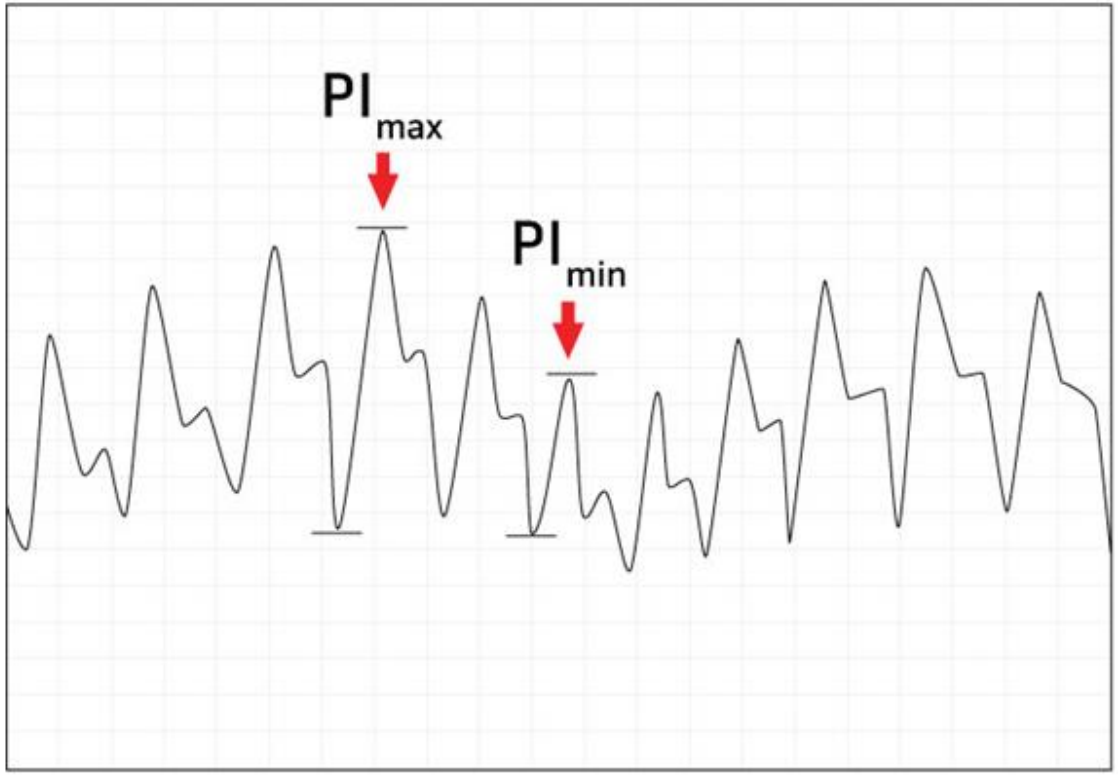
Indicadores **dinamicos** se basan en la interaccion **corazon/ventilador**

Es **necesario** que el paciente sea **ventilado mecanicamente**

Los **cambios** en la **P toracica** afectan el retorno venoso y el VE

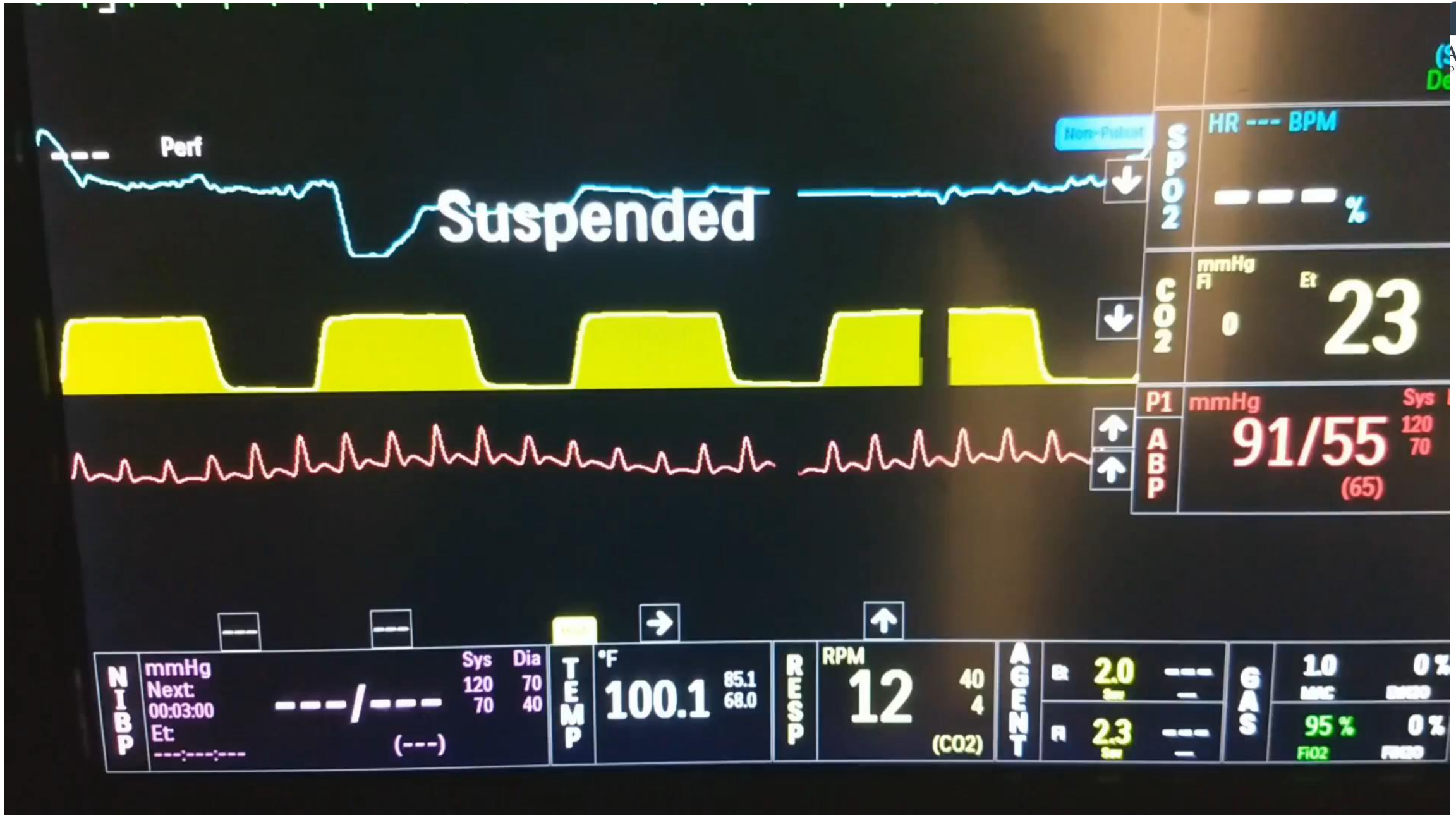
Esto produce **cambios ciclicos** en el **VE**

PVI = (Pmax – Pmin)/Pmax



Si se observa a simple vista, suelen responder a fluidoterapia


ECG (mV)
ECG
61
CO2 (mmHg)
0.0/2
Inspired / Ex
AP (cmH2O)
22/5
PIP / PE
Airway Pressure
CO2 (mmHg)
ECG Print
Start
Phases
Start
ISO (%)
0.8/0.7
Inspired / Expired
ISO
SPO2 (%)
Sensor
Poor Signal
Oxygen (%)
88/8
Inspired / Exp
ECG/IBP
CO2
Oxygen
Agent
N2O
SpO2
AP
Temp
Traces/Trends


Perf
Suspended
Non-Pulsat
SPO2
HR --- BPM

%
CO2
mmHg
Et
0
23
P1
ABP
mmHg
91/55
(65)
Sys
120
70
NIBP
mmHg
Next:
00:03:00
Et:
---:---:---
---/---
(---)
Sys
Dia
120
70
70
40
TEMP
°F
100.1
85.1
68.0
RESP
RPM
12
40
4
(CO2)
AGENT
Et
2.0
Fi
2.3
GAS
1.0
MAC
0 %
95 %
FiO2
0 %

Riesgos de fluidoterapia excesiva

Inefectiva

Anemia por **dilucion**

Edema en zona quirurgica – afecta la cicatrizacion

Complicaciones pulmonares

Effect of Intraoperative Fluid Management on Outcome after Intraabdominal Surgery

Vadim Nisanevich, M.D.,* Itamar Felsenstein, M.D.,† Gidon Almogy, M.D.,† Charles Weissman, M.D.,‡ Sharon Einav, M.D.,§ Idit Matot, M.D.‖

ACVAA
FOUNDED IN 1975

Background: The debate over the correct perioperative fluid management is unresolved.

Methods: The impact of two intraoperative fluid regimes on postoperative outcome was prospectively evaluated in 152 patients with an American Society of Anesthesiologists physical status of I–III who were undergoing elective intraabdominal surgery. Patients were randomly assigned to receive intraoperatively either liberal (liberal protocol group [LPG], n = 75; bolus of 10 ml/kg followed by 12 ml · kg^{-1} · h^{-1}) or restrictive (restrictive protocol group [RPG], n = 77; 4 ml · kg^{-1} · h^{-1}) amounts of lactated Ringer's solution. The primary endpoint was the number of patients who died or experienced complications. The secondary endpoints included time to initial passage of flatus and feces, duration of hospital stay, and changes in body weight, hematocrit, and albumin serum concentration in the first 3 postoperative days.

Results: The number of patients with complications was lower in the RPG ($P = 0.046$). Patients in the LPG passed flatus and feces significantly later (flatus, median [range]: 4 [3–7] days in the LPG *vs.* 3 [2–7] days in the RPG; $P < 0.001$; feces: 6 [4–9] days in the LPG *vs.* 4 [3–9] days in the RPG; $P < 0.001$), and their postoperative hospital stay was significantly longer (9 [7–24] days in the LPG *vs.* 8 [6–21] days in the RPG; $P = 0.01$). Significantly larger increases in body weight were observed in the LPG compared with the RPG ($P < 0.01$). In the first 3 postoperative days, hematocrit and albumin concentrations were significantly higher in the RPG compared with the LPG.

Conclusions: In patients undergoing elective intraabdominal surgery, intraoperative use of restrictive fluid management may be advantageous because it reduces postoperative morbidity and shortens hospital stay.

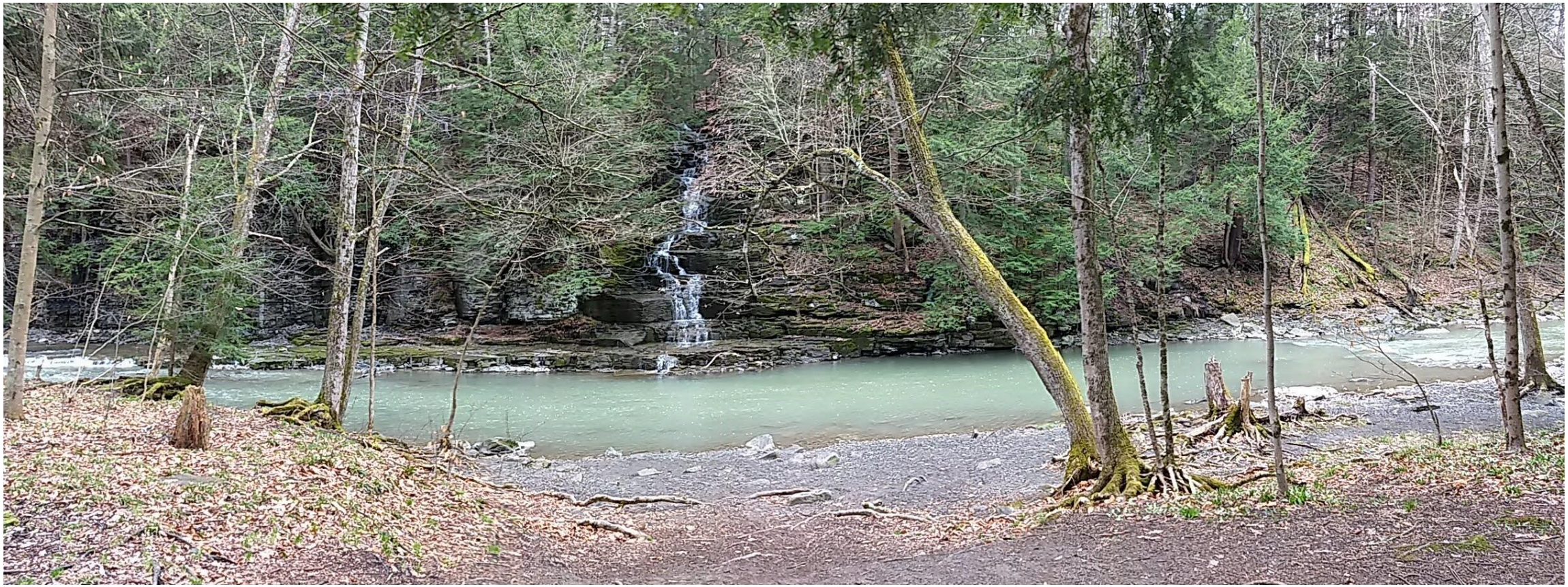
Fluidoterapia en Cornell

Antes: 10mL/kg/hora

Despues: 10 mL/kg primera hora, luego 5 mL/kg/hora

Ahora: 5 mL/kg/hora. 3 mL/kg/hora en cardiopatas o hipoproteinemicos

Gracias



Regurgitacion y vomitos

- La regurgitacion es comun en animals anestesiados, aun cuando no resulta en vomito
- Inclusive en animales con ayuno
- Incidencia reportada entre 45-80% durante anesthesia
- Es dificil de diagnosticar si no se observa en cavidad oral

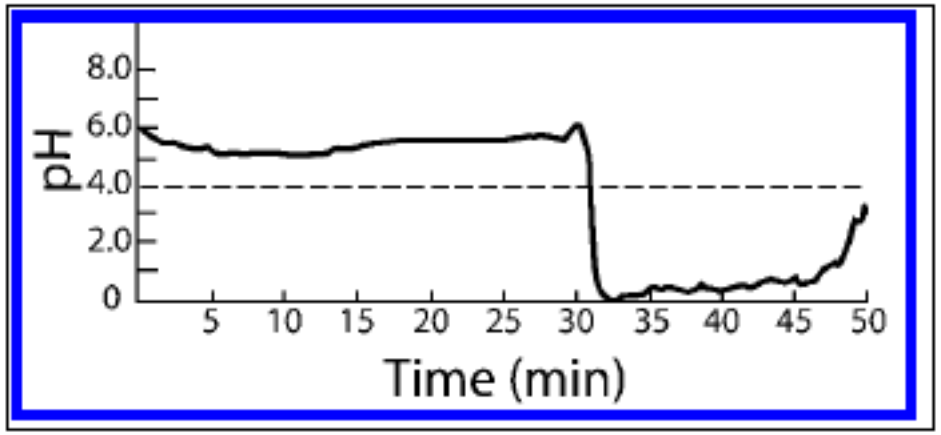


Figure 1—Recorded tracing of esophageal pH for a representative dog that had an episode of GER during anesthesia. The threshold for defining an episode of GER (ie, pH, 4.0) is indicated (horizontal dashed line).

Wilson AJVR 2006

Regurgitacion y vomitos

	Maropitant (M)	Saline (S)
I. Population data		
Gender		
Males (intact/neutered)	5 (1/4)	3 (1/2)
Females (intact/spayed)	8 (6/2)	10 (7/3)
Age (years)	2.8 ± 3.0	3.4 ± 3.3
Body weight (kg)	21.5 ± 12.5	19.4 ± 10.7
II. Study data		
Total anesthesia time (minutes)	162 ± 41	146 ± 52
Incidence of vomiting/retching	0/13 dogs	6/13 dogs*
Incidence of GER	4/13 dogs	6/13 dogs
Number of reflux events/case	4 ± 5 (n = 4)	2 ± 1 (n = 6)
Minimum pH during each GER	2.1 ± 0.8	2.2 ± 1.0
Initial esophageal pH		
No GER	6.6 ± 0.8 (n = 9)	6.1 ± 1.5 (n = 7)
GER	5.7 ± 0.9 (n = 4)	6.5 ± 0.6 (n = 6)
Ending esophageal pH		
No GER	6.5 ± 0.6 (n = 9)	6.0 ± 0.8 (n = 7)
GER	4.3 ± 1.7 (n = 4)†	4.1 ± 1.5 (n = 6)†‡

*p = 0.015 *versus* Group M. †Group M: p = 0.004, Group S:

Maropitant prevented vomiting but not gastroesophageal reflux in anesthetized dogs premedicated with acepromazine-hydromorphone

Rebecca A Johnson

Metoclopramida

Table 2—Results for dogs undergoing elective orthopedic surgery and evaluated to determine the incidence of GER during anesthesia. All values are reported as mean ± SD unless otherwise indicated.

Variable	Saline	Low*	High†
No. of dogs	18	16	18
Vomited after preanesthetic medication‡	8 (44%)	8 (50%)	12 (67%)
Dose of thiopental (mg/kg)	8.7 ± 1.9	8.9 ± 1.5	8.8 ± 2.9
GER‡	12 (67%)[a]	7 (44%)	6 (33%)[b]
Interval until onset of GER (min)	21.8 ± 25.8	34.6 ± 46.4	49.5 ± 66.4
Duration of reflux (min)	96.9 ± 58.6	109.7 ± 87.8	90.3 ± 60.2
No. of episodes of GER/affected dog	1.8 ± 1.2	2.8 ± 2.9	1.7 ± 1.0
Lowest pH recorded§	0.1–3.6	0.1–3.6	1.0–3.7
Initial blood pressure (mm Hg)‖	65 ± 7.2	66 ± 8.5	71 ± 14.7
Ending blood pressure (mm Hg)‖	80 ± 12.6	80 ± 14.2	84 ± 16.6
Initial heart rate (beats/min)	78 ± 19.1	78 ± 15.7	77 ± 15.1
Ending heart rate (beats/min)	86 ± 16.8	94 ± 17.0	89 ± 19.5

‡Data reported as number of dogs (%). §Values reported are the range. ‖Data were recorded during surgery (approx 1 hour after induction of anesthesia).
[a,b]Values with different superscript letters differ significantly ($P = 0.045$).
See Table 1 for remainder of key.

Influence of metoclopramide on gastroesophageal reflux in anesthetized dogs

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Metoclopramida

Evaluation of metoclopramide and ranitidine on the prevention of gastroesophageal reflux episodes in anesthetized dogs

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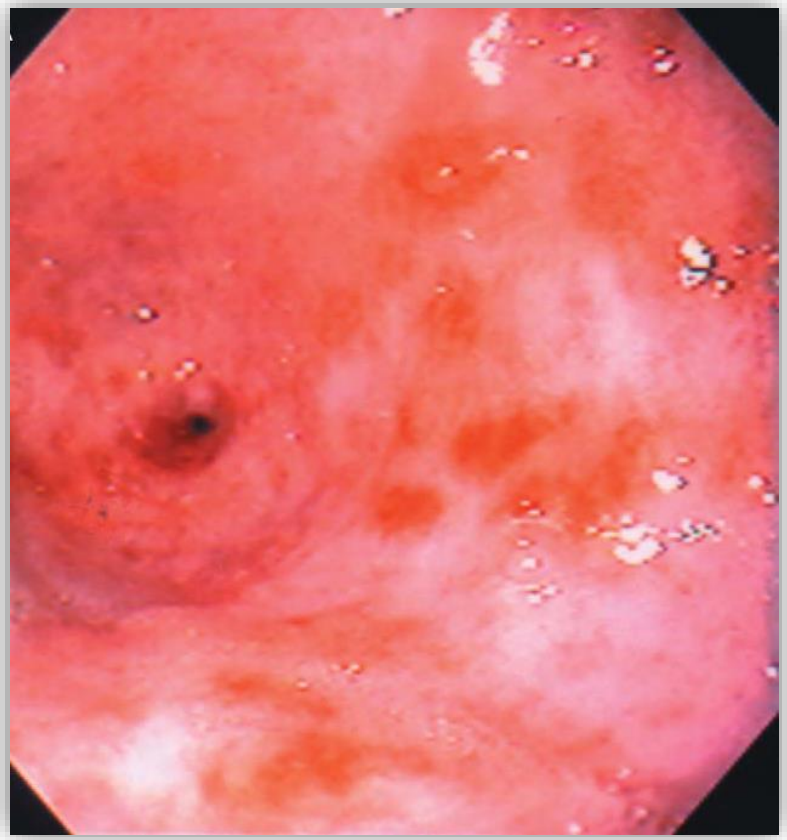
- 90 perros: ACP 0.1 mg/kg, propofol, isoflurane
- Control, metoclop (1 mg/kg + 1 mg/kg/h) y ranitidine (2 mg/kg)
- Reflujo: control 7; metoclop 1 y ranitidine 4
- Importante: solo 8% total de regurgitacion; sin opioides

Vomitos

- El vomito en animales sedados/anestesiados puede resultar en broncoaspiracion
- Narcoticos y agentes inhalatorios inducen vomitos (induccion por mascara)

- Como actuar?
- *Cabeza hacia abajo*
- *Aspiracion*
- *Laringoscopia*




Manx