Choc cardiogénique
PHL 6077

André Y. Denault MD PhD FRCPC ABIM-CCM FASE
Professeur agrégé de clinique
Département d'anesthésiologie
Service de soins intensifs
Octobre 2012

Objectifs

- Comprendre les 3 grands mécanismes de l'instabilité hémodynamique dont le choc cardiogénique
- Apprécier l'importance de l'échocardio-graphie dans les situations critiques d'hypotension
- Connaître les principes thérapeutiques en fonction des mécanismes d'instabilité

http://www.anesth.umontreal.ca/Denault.html

PHL-6077 Choc cardiogénique

2010 Septembre Fonction cardiaque

2010 Septembre Fonction cardiaque partie 2

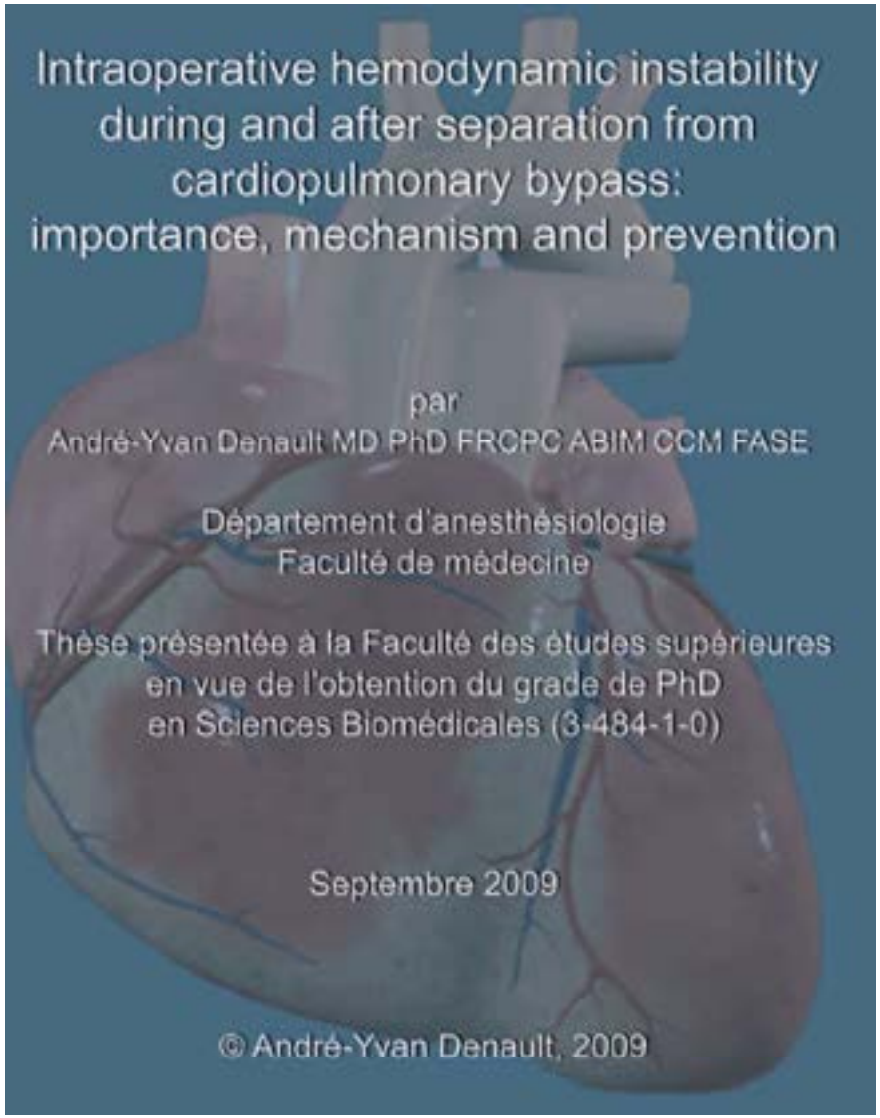
Atlas of cardiovascular monitoring (12 Mo)

2010 Octobre Fonction cardiaque et instabilité hémodynamique : partie III
Atelier pratique en échographie

2010 Novembre Fonction diastolique

2010 Thèse de Doctorat : mécanisme de l'instabilité hémodynamique en chirurgie cardiaque

2012 Janvier Instabilité hémodynamique et hypoxie: rôle de l'échographie ciblée


Intraoperative hemodynamic instability during and after separation from cardiopulmonary bypass: importance, mechanism and prevention
par
André-Yvan Denault MD PhD FRCPC ABIM CCM FASE
Département d'anesthésiologie
Faculté de médecine
Thèse présentée à la Faculté des études supérieures en vue de l'obtention du grade de PhD en Sciences Biomédicales (3-484-1-0)
Septembre 2009
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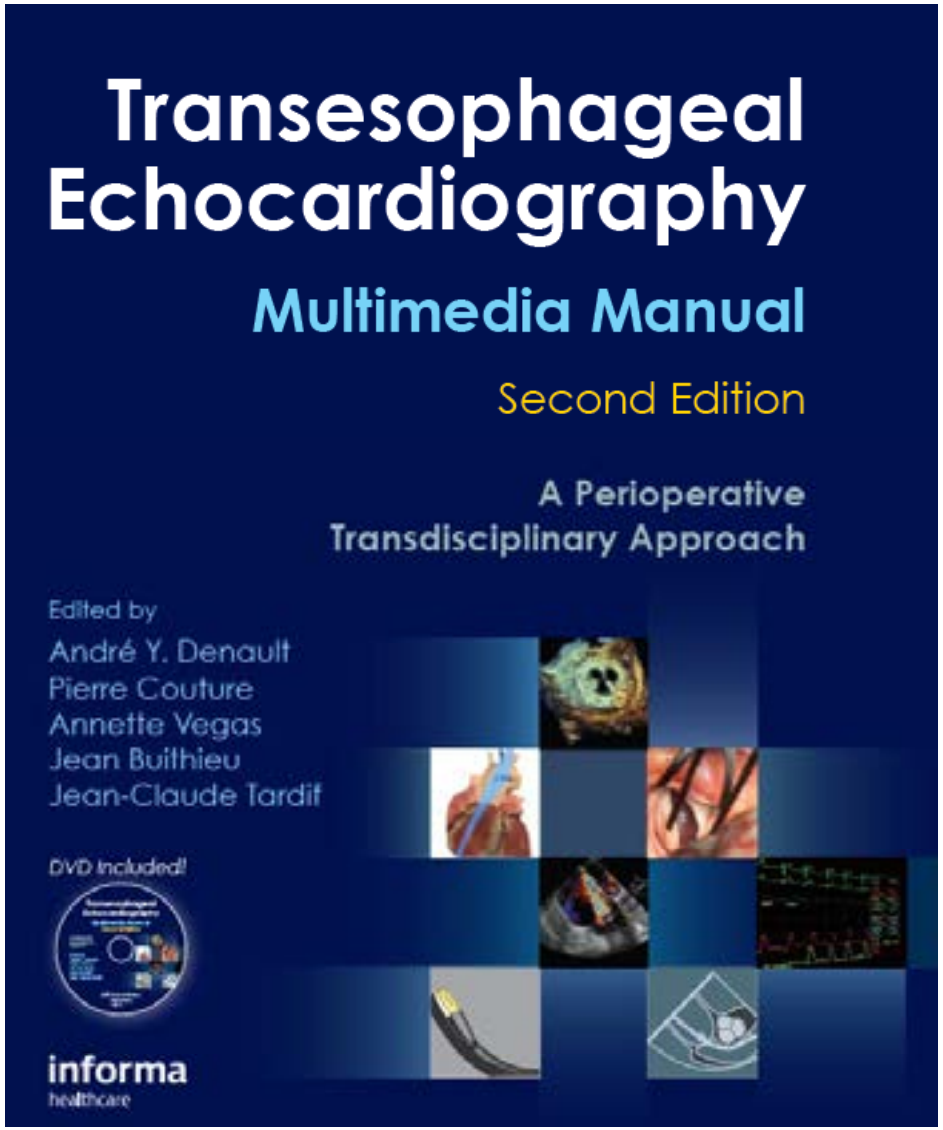
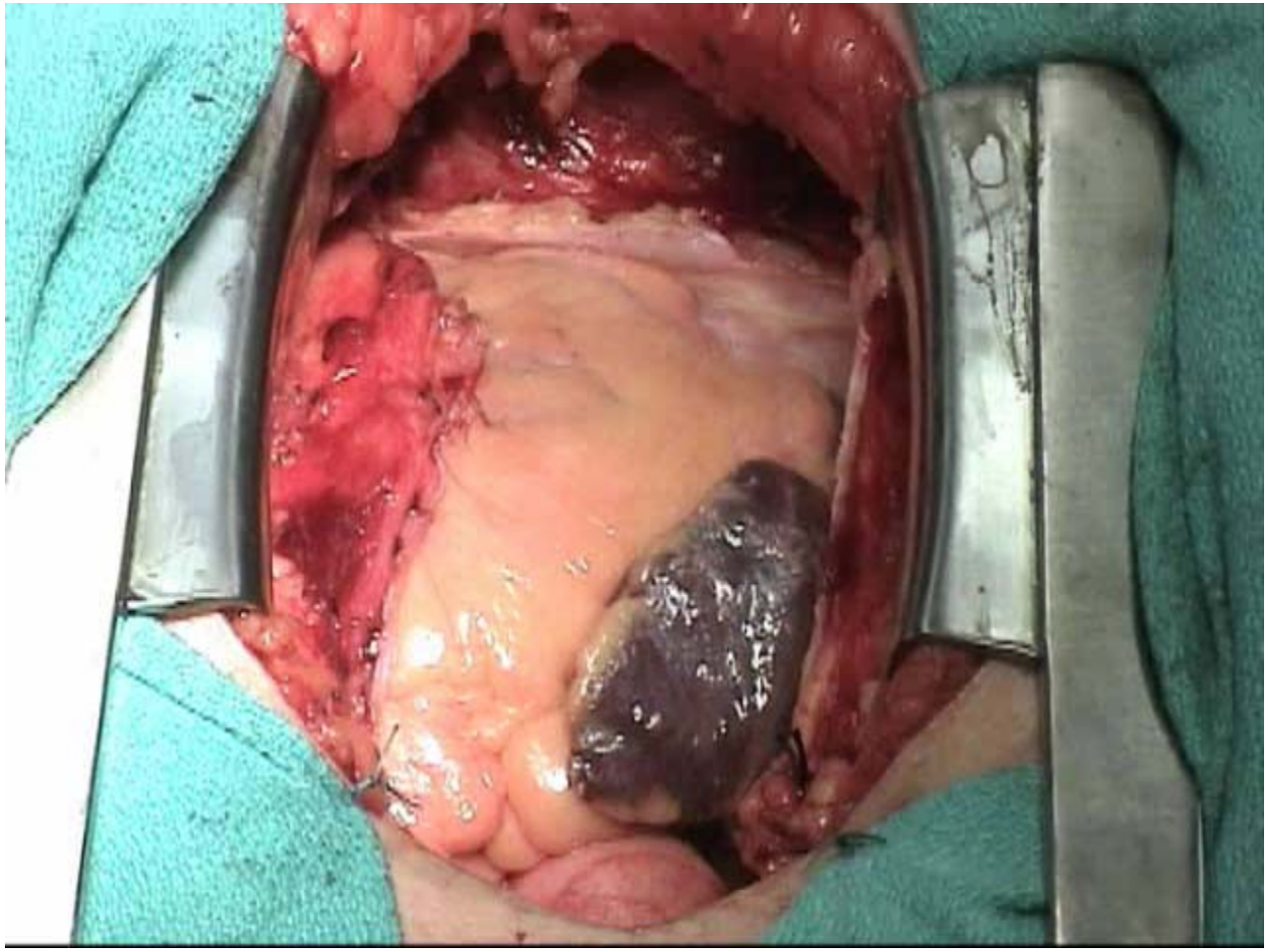

Transesophageal Echocardiography
Multimedia Manual
Second Edition
A Perioperative Transdisciplinary Approach
Edited by
André Y. Denault
Pierre Couture
Annette Vegas
Jean Buithieu
Jean-Claude Tardif
DVD included!
informa
healthcare

Chapitre 3

andre.denault@umontreal.ca

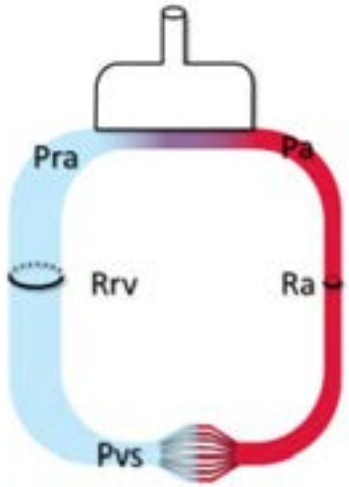
Choc cardiogénique
PHL 6077



Définition

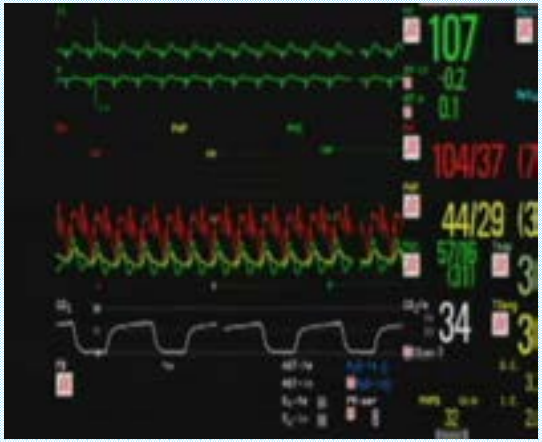
Importance

Mécanisme



Approche

Définition

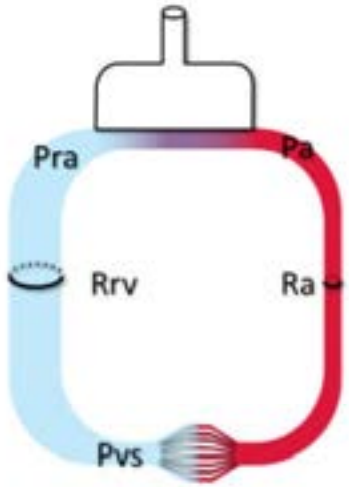


Importance


The NEW ENGLAND JOURNAL of MEDICINE

A Comparison of Aprotinin and Lysine Analogues in High-Risk Cardiac Surgery

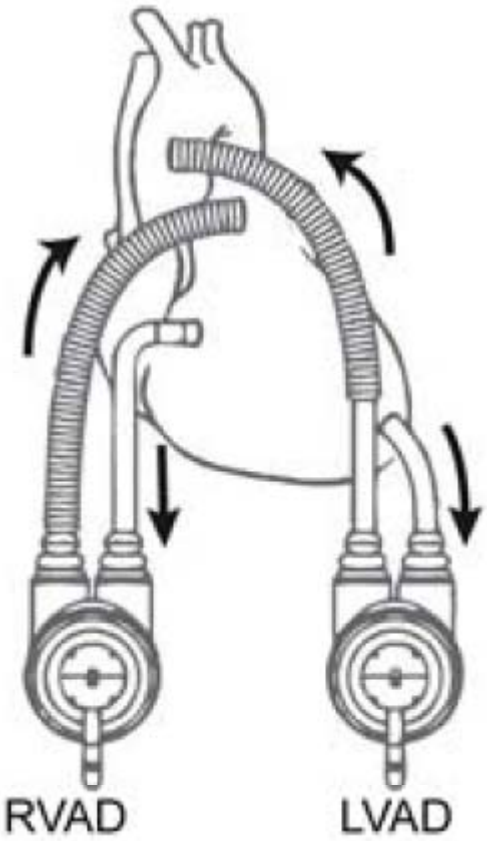
Mécanisme

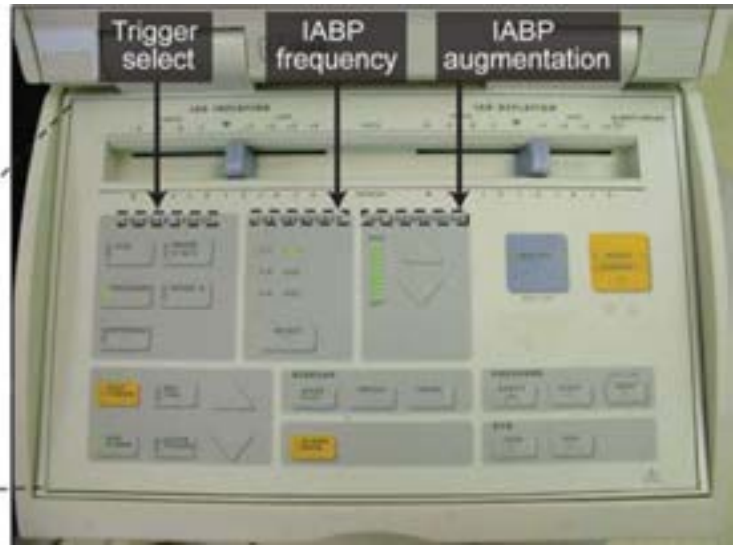


Approche

Difficult separation from CPB

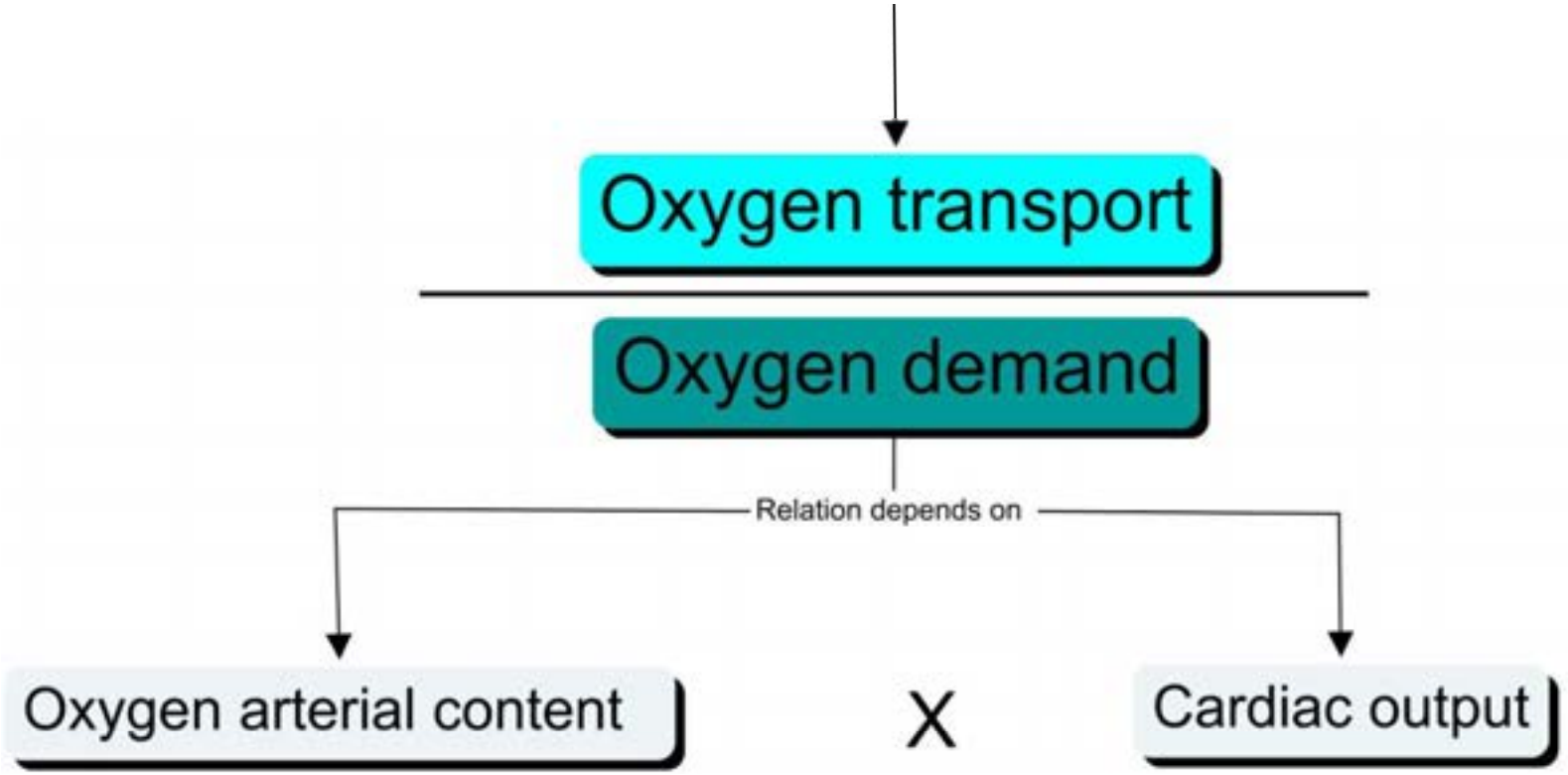

ALARMES DE
II
V
FC
107
ST-II
-0.2
ST-V
0.1
PAP
PVC
104/37
PAP
44/29
PVC
57(16)
(31)
CO2
50
CO2fe
34
CO2mi 0


RVAD
LVAD


Trigger select
IABP frequency
IABP augmentation


3470
500
128

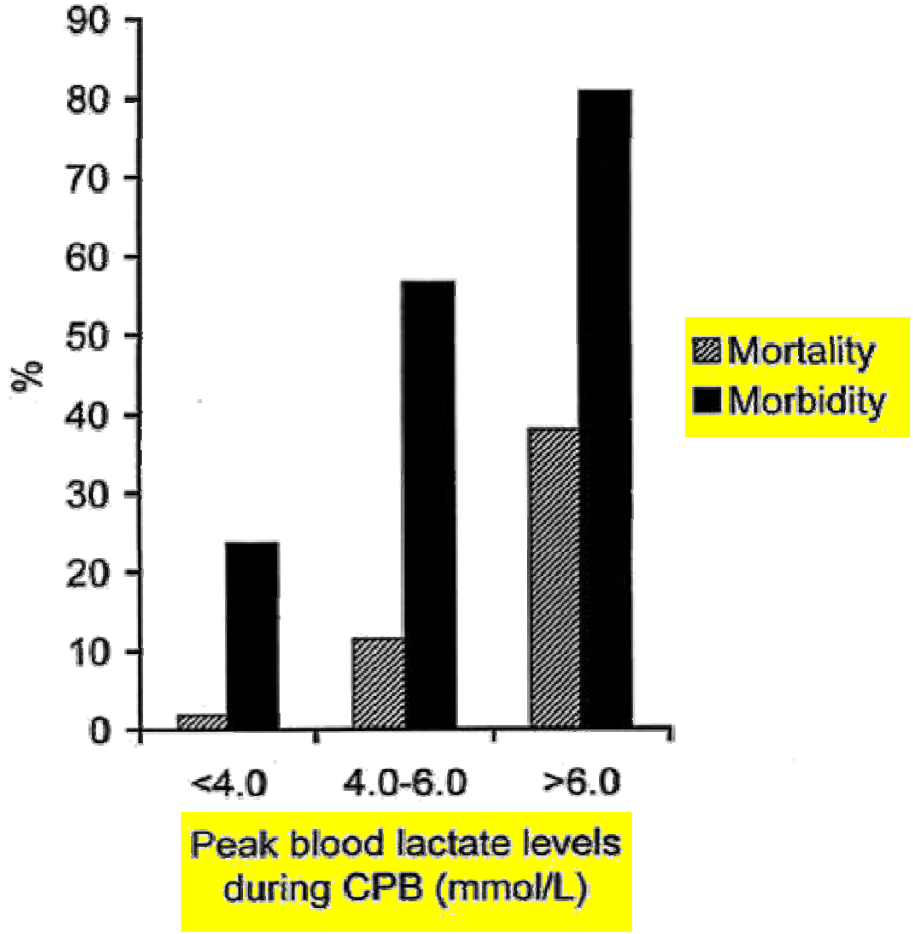
Choc cardiogénique



Outcome With High Blood Lactate Levels During Cardiopulmonary Bypass in Adult Cardiac Operation

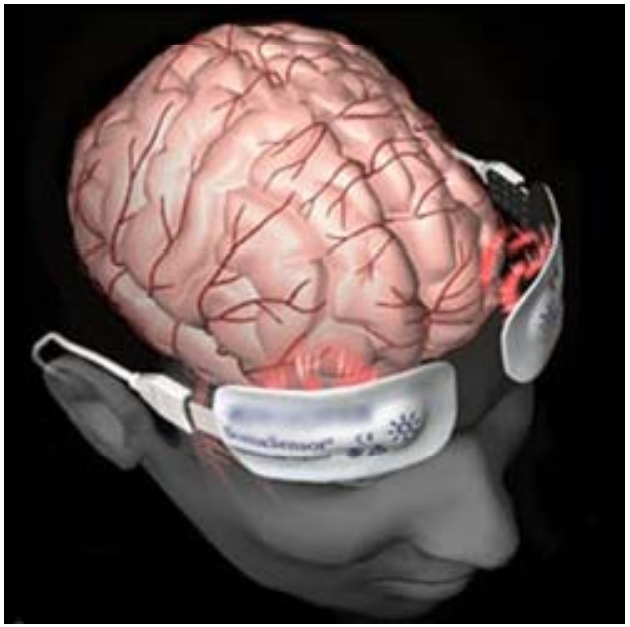
Philippe Demers, MD, Stéphane Elkouri, MD, Raymond Martineau, MD, André Couturier, MSc, and Raymond Cartier, MD

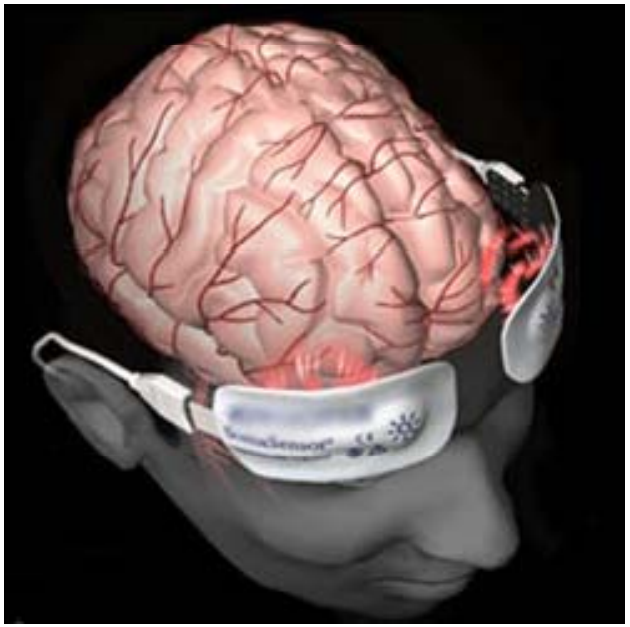
Division of Cardiothoracic Surgery, Departments of Surgery, and Departments of Anesthesia and Biostatistics, Montreal Heart Institute, Montreal, Quebec, Canada

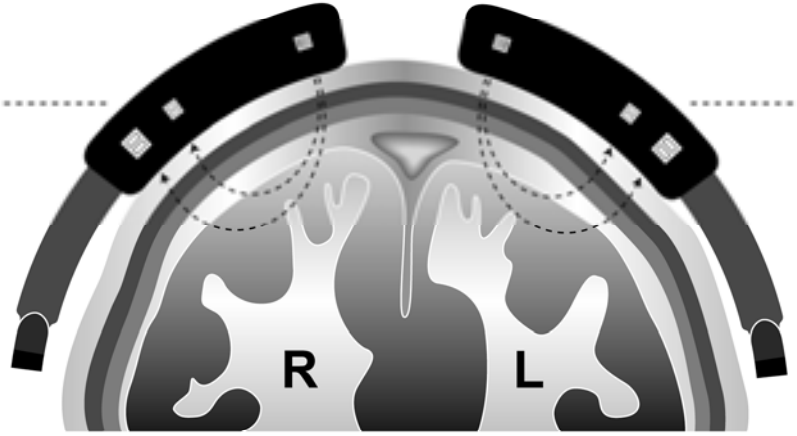


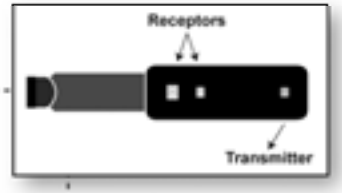
Demers et al ATS 2000

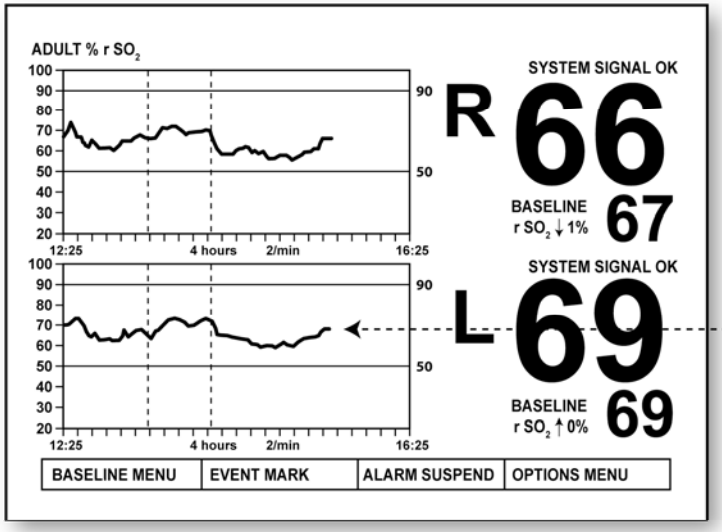
At the same time






R
L


Receptors
Transmitter


ADULT % r SO2
100
90
80
70
60
50
40
30
20
12:25
4 hours
2/min
16:25
SYSTEM SIGNAL OK
R
66
BASELINE
r SO2 ↓ 1%
67
SYSTEM SIGNAL OK
L
69
BASELINE
r SO2 ↑ 0%
69
BASELINE MENU
EVENT MARK
ALARM SUSPEND
OPTIONS MENU

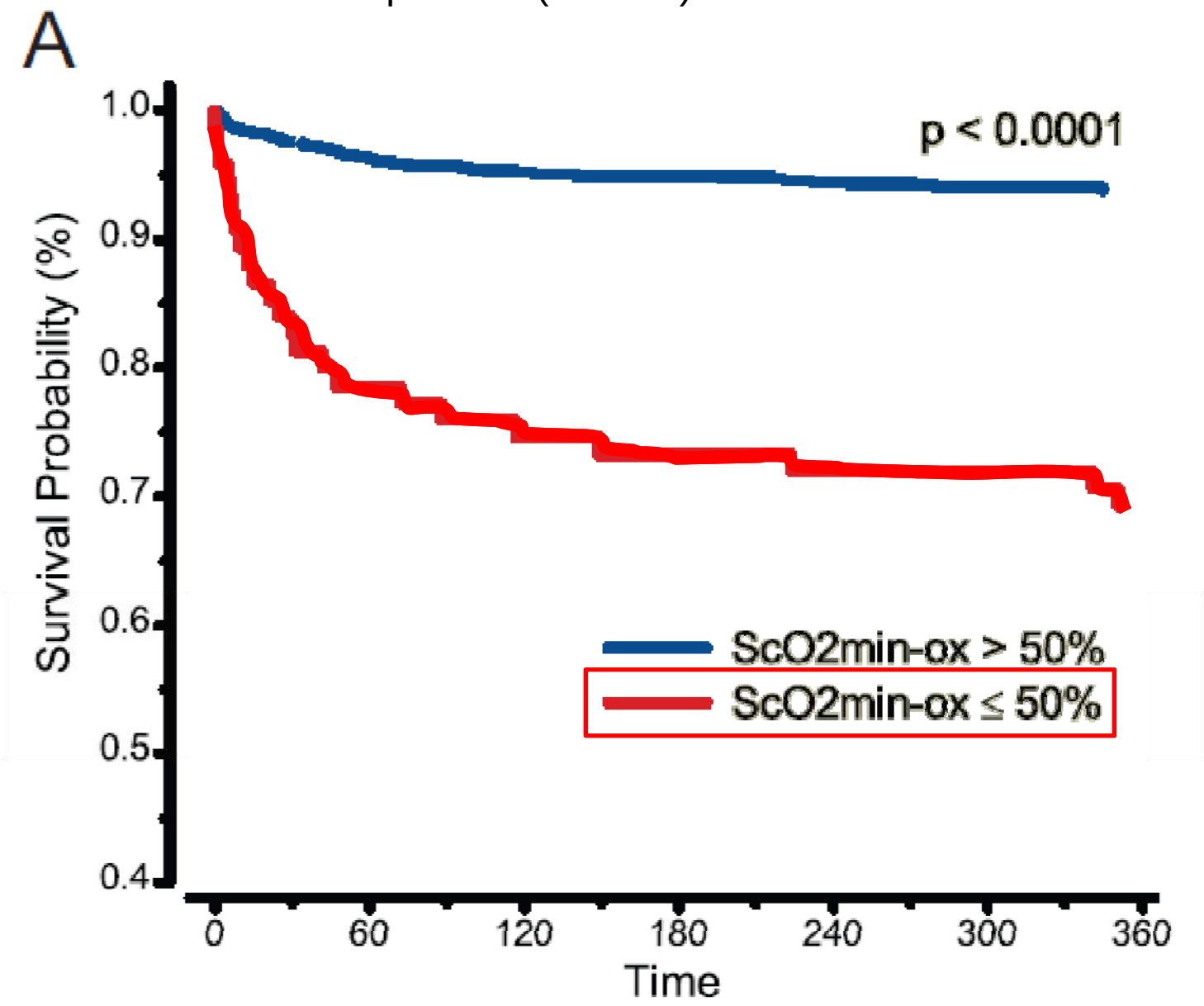
Preoperative Cerebral Oxygen Saturation and Clinical Outcomes in Cardiac Surgery

Matthias Heringlake, M.D.,* Christof Garbers, Cand. Med.,† Jan-Hendrik Käbler, Cand. Med.,† Ingrid Anderson, Cand. Med.,† Hermann Heinze, M.D.,‡ Julika Schön, M.D.,‡ Klaus-Ulrich Berger, M.D.,‡ Leif Dibbelt, M.D.,§ Hans-Hinrich Sievers, M.D.,‖ Thorsten Hanke, M.D.#

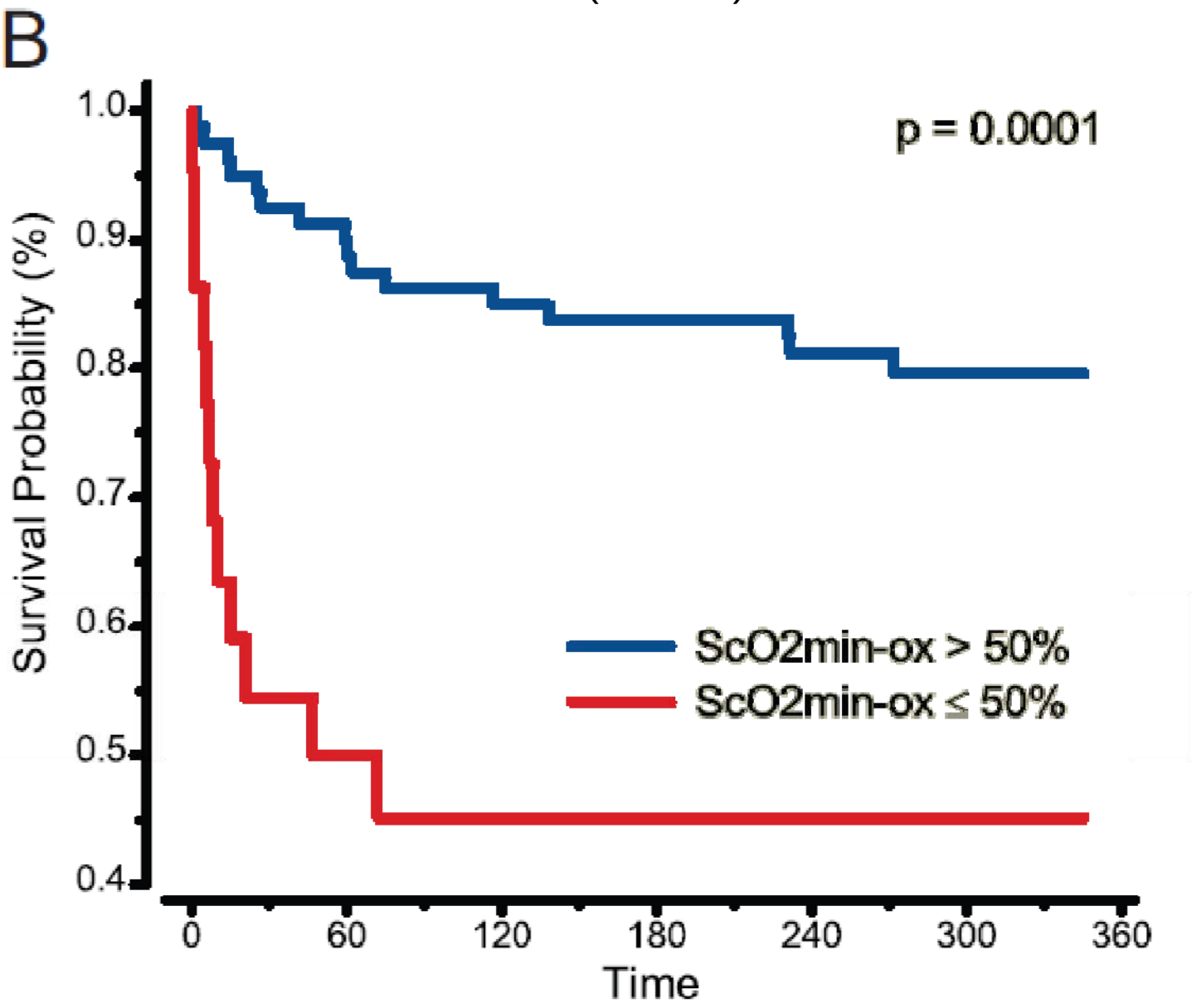
◇ This article is featured in "This Month in Anesthesiology." Please see this issue of ANESTHESIOLOGY, page 9A.

◆ This article is accompanied by an Editorial View. Please see: Murkin JM: Cerebral oximetry: Monitoring the brain as the index organ. ANESTHESIOLOGY 2011; 114:12–3.

Total Population (n=1176)



Euroscore > 10 (n = 102)



A Proposed Algorithm for the Intraoperative Use of Cerebral Near-Infrared Spectroscopy

André Denault, MD, FRCPC, ABIM-CCM,
Alain Deschamps, MD, FRCPC, PhD,
and John M. Murkin, MD, FRCPC

Seminars in Cardiothoracic and Vascular Anesthesia 2007

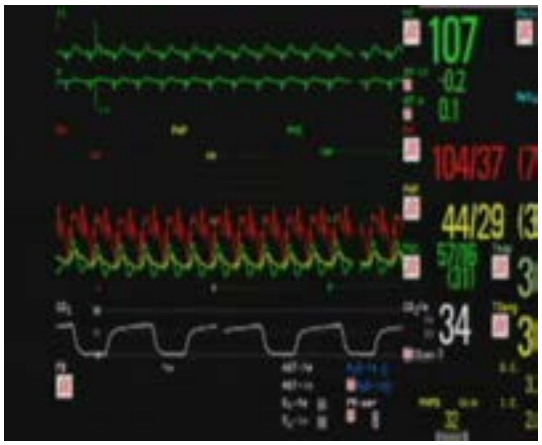
En résumé


107
-0.2
0.1
104/37
44/29
57/16
34
32

=

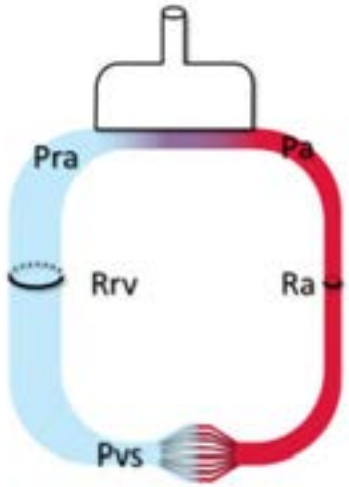

PEDIATRIC
25.09.05
L 36
SYSTEM SIGNAL OK
R 43
LEFT
RIGHT
MAIN MENU

Définition



Importance

Mécanisme



Approche

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 MARCH 4, 2010 VOL. 362 NO. 9

Comparison of Dopamine and Norepinephrine in the Treatment of Shock

Daniel De Backer, M.D., Ph.D., Patrick Biston, M.D., Jacques Devriendt, M.D., Christian Madl, M.D., Didier Chochrad, M.D., Cesar Aldecoa, M.D., Alexandre Brasseur, M.D., Pierre Defrance, M.D., Philippe Gottignies, M.D., and Jean-Louis Vincent, M.D., Ph.D., for the SOAP II Investigators*

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Table 2. Mortality Rates.*

Time Period	Dopamine	Norepinephrine	Odds Ratio (95% CI)†	P Value
	percent mortality			
During stay in intensive care unit	50.2	45.9	1.19 (0.98–1.44)	0.07
During hospital stay	59.4	56.6	1.12 (0.92–1.37)	0.24
At 28 days	52.5	48.5	1.17 (0.97–1.42)	0.10
At 6 mo	63.8	62.9	1.06 (0.86–1.31)	0.71
At 12 mo	65.9	63.0	1.15 (0.91–1.46)	0.34

* Data were available for 1656 patients in the intensive care unit, in the hospital, and at 28 days; for 1443 patients at 6 months; and for 1036 patients at 12 months.

† Odds ratios for death are for the comparison of the dopamine group with the norepinephrine group.


1949- 2005

6120 patients de chirurgie cardiaque 1996-1999

Sevrage facile de la CEC

Aucun Rx ou 1 seul

Sevrage difficile de la CEC

Inotropes + vasopresseurs

Sevrage très difficile de la CEC

Retour sous CEC
Assistance mécanique

INSTITUT DE CARDIOLOGIE DE MONTRÉAL

6120 patients de chirurgie cardiaque 1996-1999

Sevrage facile de la CEC

Aucun Rx ou 1 seul

n = 3253 (53.1%)

Sevrage difficile de la CEC

Inotropes + vasopresseurs

n = 2466 (40.3%)

Sevrage très difficile de la CEC

Retour sous CEC
Assistance mécanique

n = 401 (6.6%)

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Retour sous CEC
Assistance mécanique

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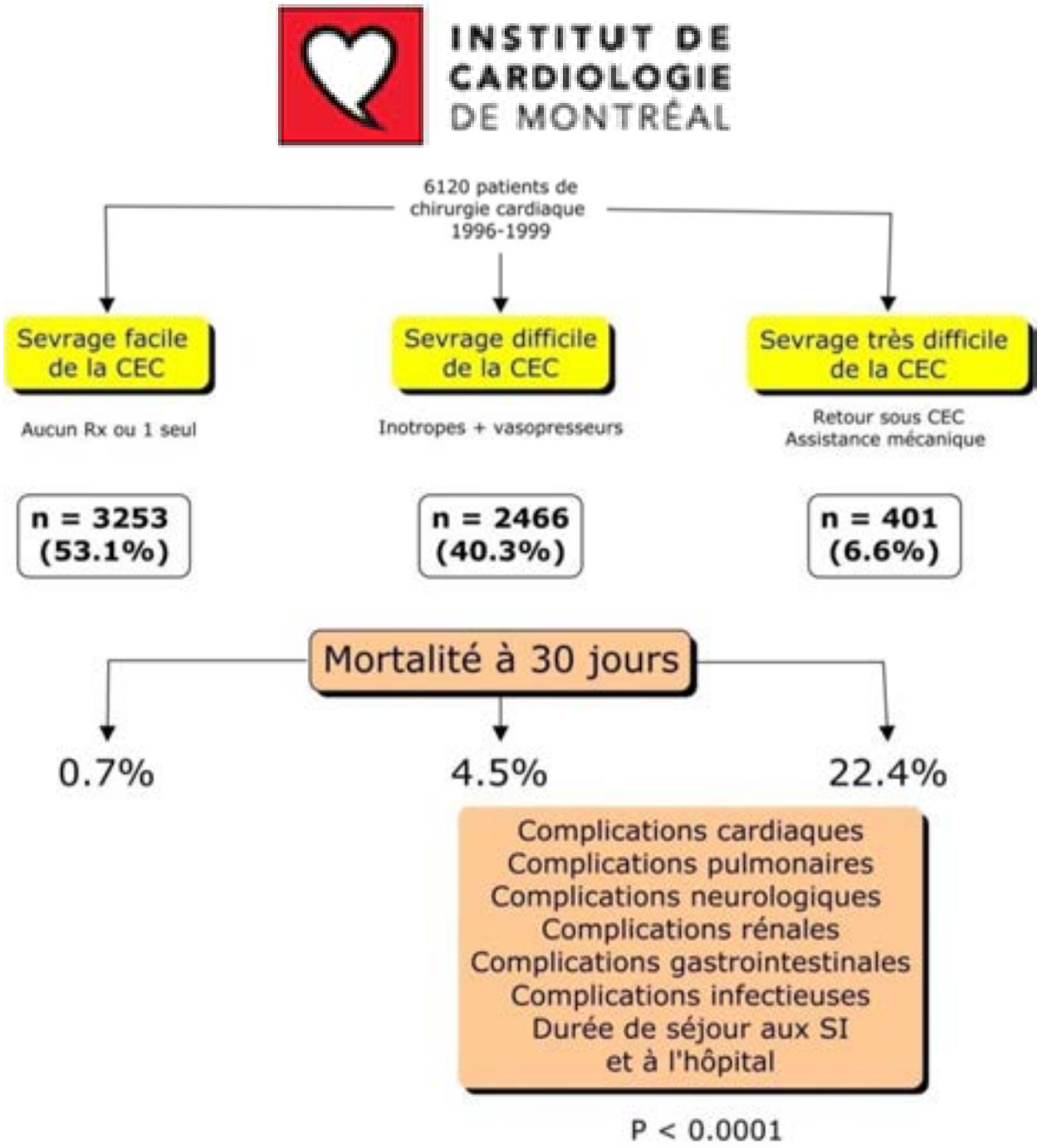
Mortalité à 30 jours

0.7%

4.5%

22.4%


INSTITUT DE CARDIOLOGIE DE MONTRÉAL
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Retour sous CEC
Assistance mécanique
n = 401 (6.6%)
Mortalité à 30 jours
0.7%
4.5%
22.4%
Complications cardiaques
Complications pulmonaires
Complications neurologiques
Complications rénales
Complications gastrointestinales
Complications infectieuses
Durée de séjour aux SI
et à l'hôpital
P < 0.0001

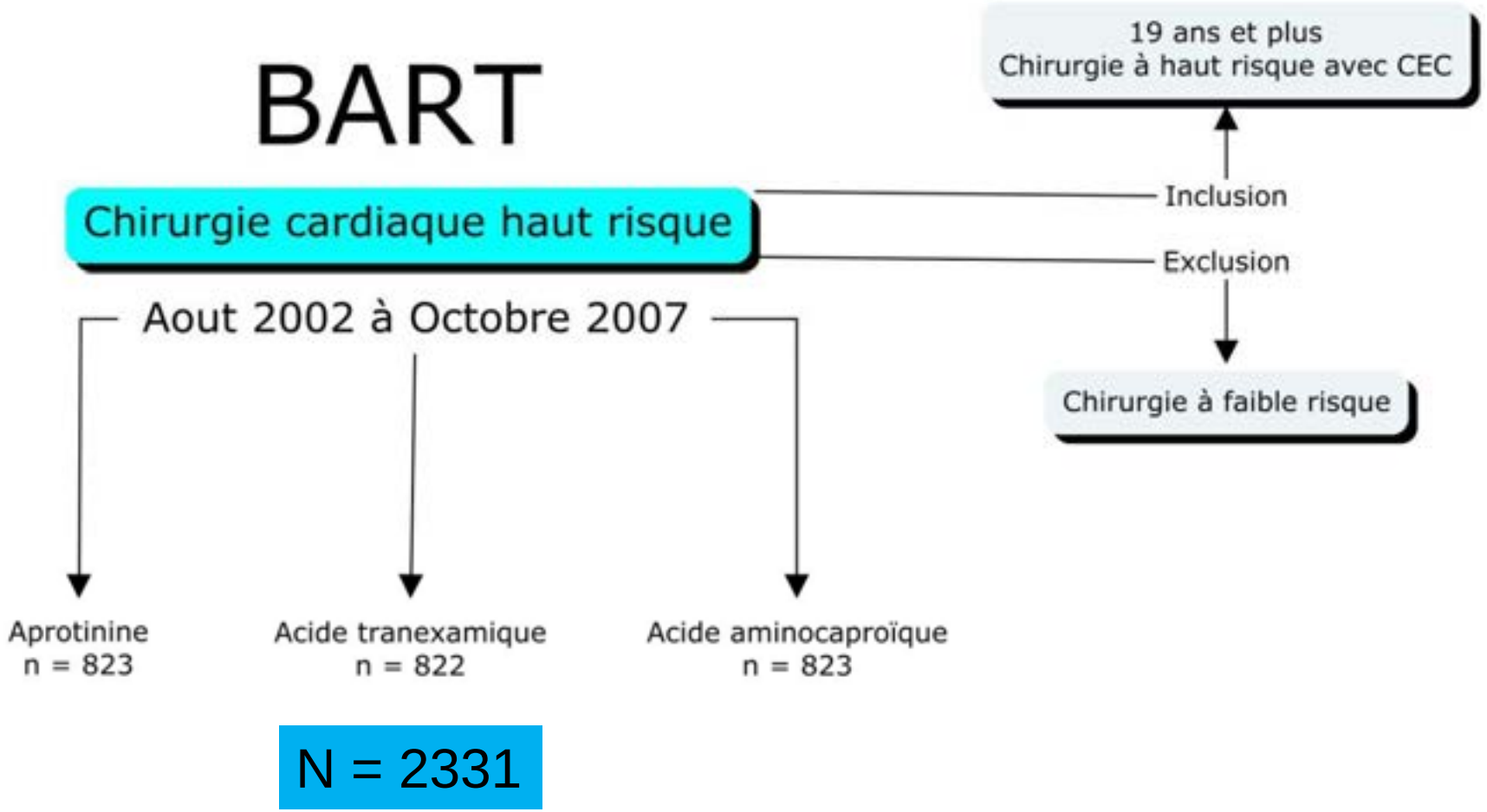
The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 MAY 29, 2008 VOL. 358 NO. 22

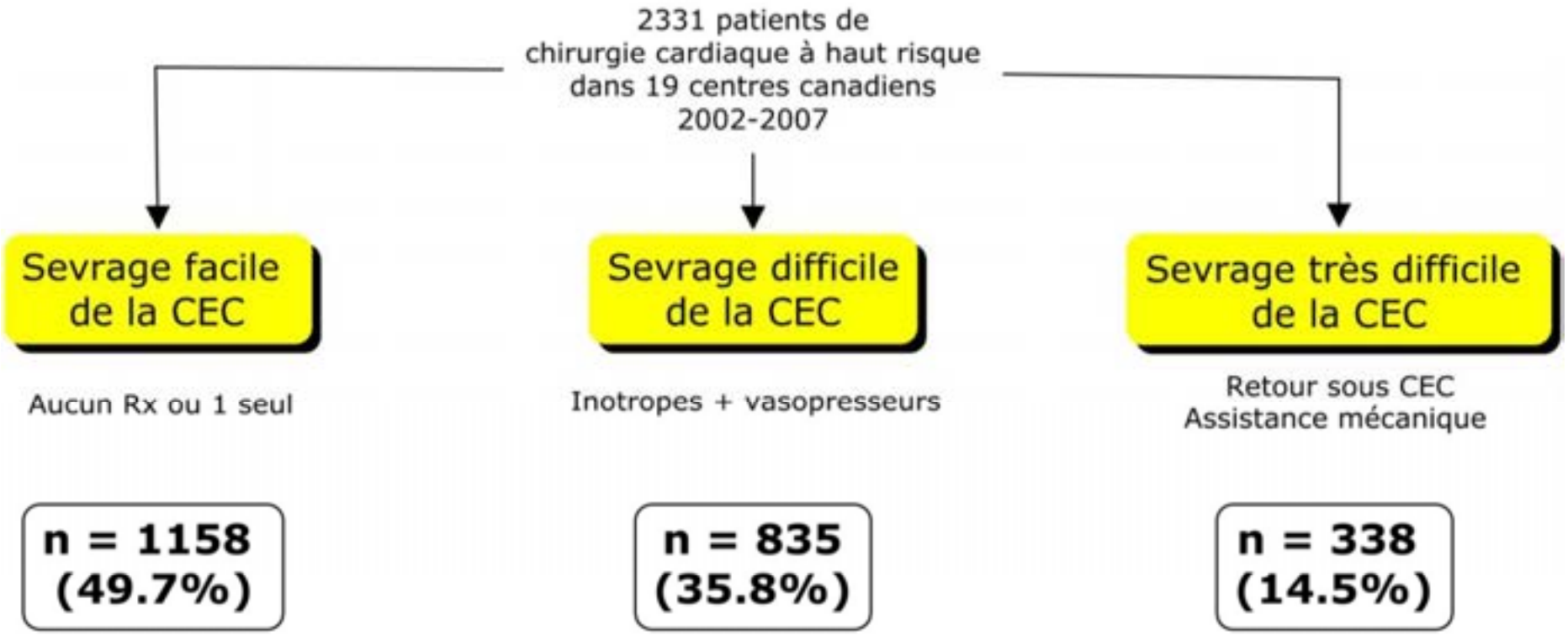
A Comparison of Aprotinin and Lysine Analogues in High-Risk Cardiac Surgery

Dean A. Fergusson, M.H.A., Ph.D., Paul C. Hébert, M.D., M.H.Sc., C. David Mazer, M.D., Stephen Fremes, M.D., Charles MacAdams, M.D., John M. Murkin, M.D., Kevin Teoh, M.D., M.Sc., Peter C. Duke, M.D., Ramiro Arellano, M.D., M.Sc., Morris A. Blajchman, M.D., Jean S. Bussières, M.D., Dany Côté, M.D., Jacek Karski, M.D., Raymond Martineau, M.D.,* James A. Robblee, M.D., M.B.A., Marc Rodger, M.D., M.Sc., George Wells, Ph.D., Jennifer Clinch, M.A., and Roanda Pretorius, M.Sc., for the BART Investigators†

A Comparison of Aprotinin and Lysine Analogues in High-Risk Cardiac Surgery



A Comparison of Aprotinin and Lysine Analogues in High-Risk Cardiac Surgery



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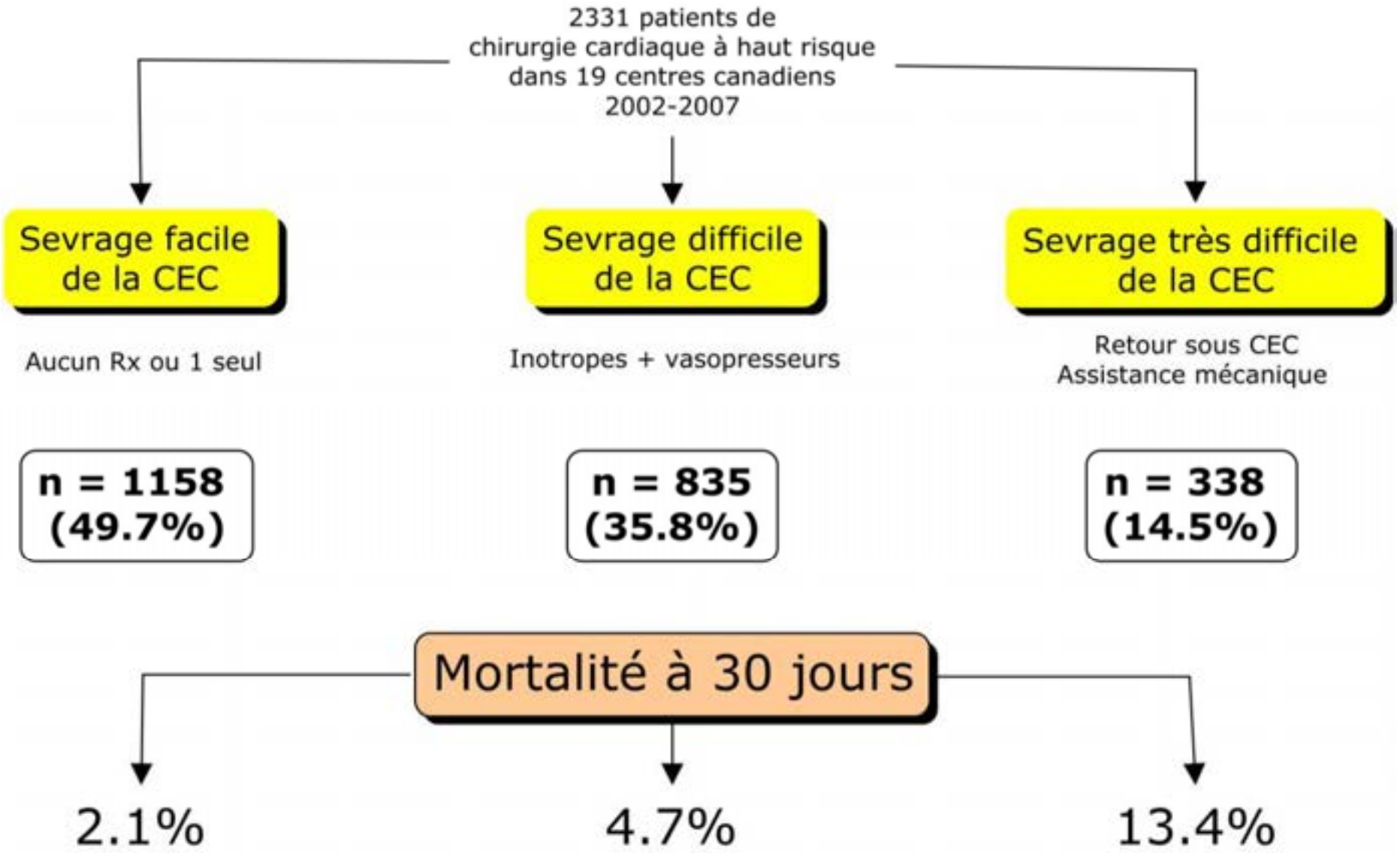
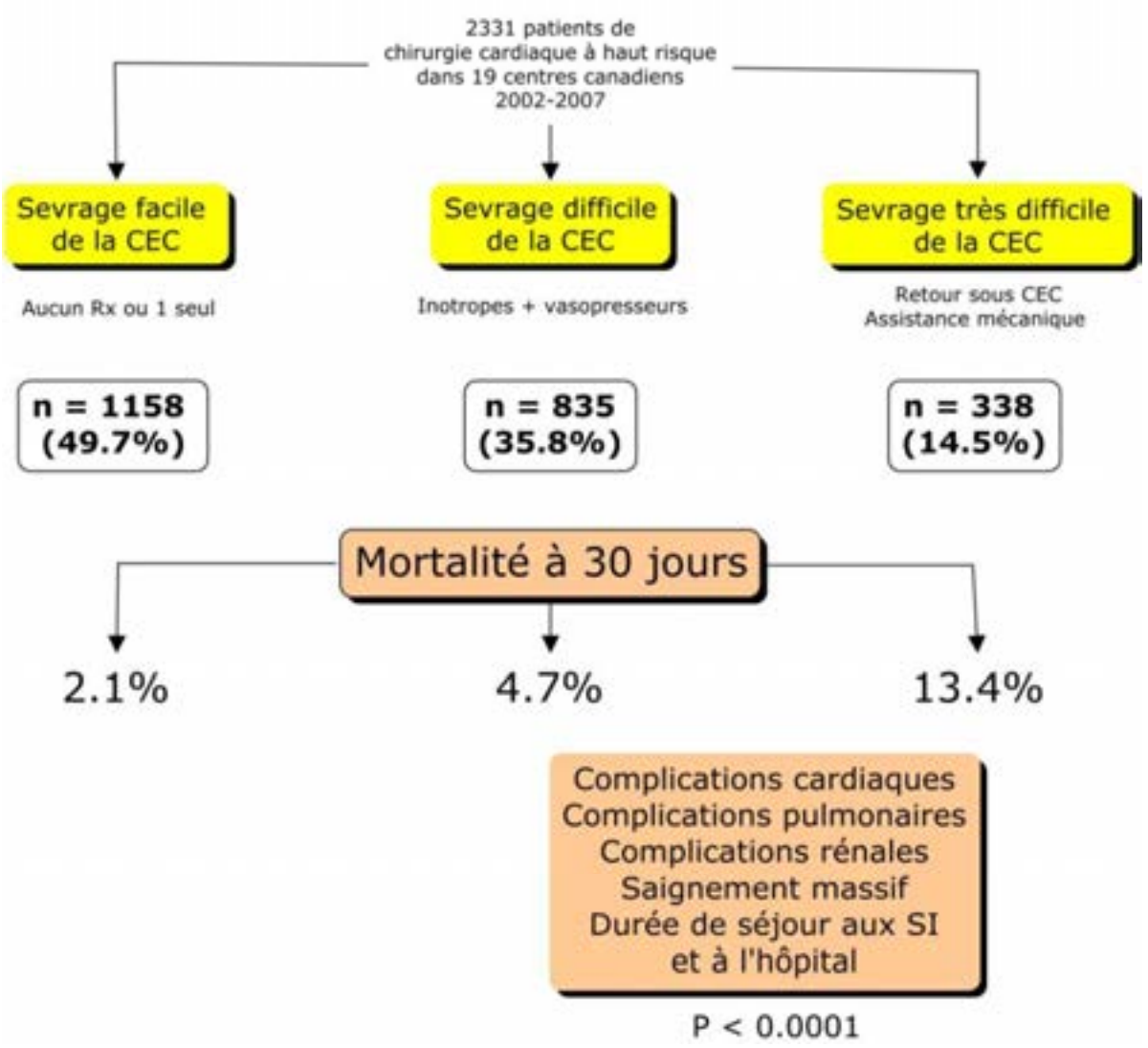


A Comparison of Aprotinin and Lysine Analogues in High-Risk Cardiac Surgery



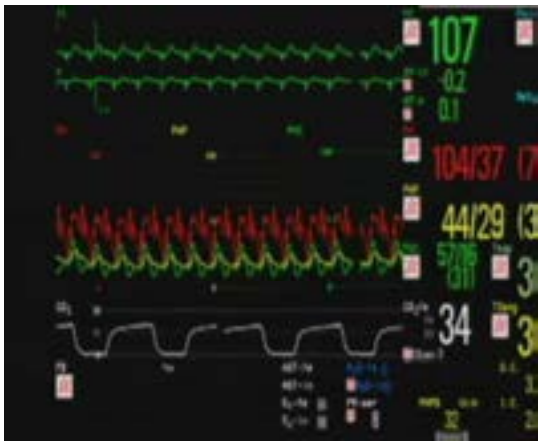
A Comparison of Aprotinin and Lysine Analogues in High-Risk Cardiac Surgery

Prédictors of mortality

Variables	B ± SE	Odds Ratio	95% CI	*P* value
Age (10 units)	0.0443 ± 0.0131	1.557	1.213-2.028	0.0007
Renal disease	0.6526 ± 0.3184	1.921	1.029-3.585	0.0404
Use of diuretics	0.5644 ± 0.2355	1.758	1.108-2.790	0.0165
Hemoglobin (1 unit)	-0.0147 ± 0.00692	0.985	0.972-0.999	0.0342
Prothrombin time (10 units)	0.0091 ± 0.00316	1.096	1.024-1.164	0.0039
Easy *vs.* difficult separation from CPB	0.5155 ± 0.2875	1.674	0.953-2.942	0.0730
Easy *vs.* very difficult separation from CPB	1.1285 ± 0.3033	3.091	1.706-5.601	0.0002
CPB duration (60 units)	0.0097 ± 0.0013	1.788	1.529-2.103	< 0.0001

B, estimate; BART, Blood Conservation Using Antifibrinolytics in a Randomized Trial; CI, confidence interval; CPB, cardiopulmonary bypass; SE, standard error

Définition

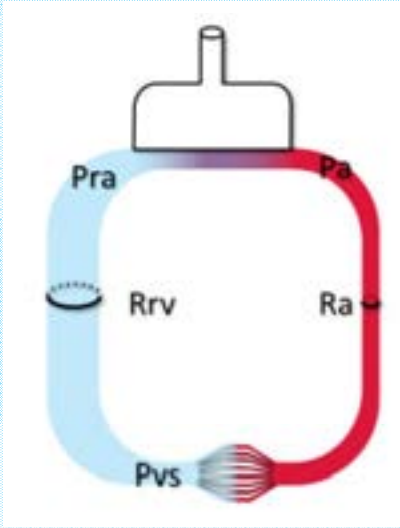


Importance


The NEW ENGLAND JOURNAL of MEDICINE

A Comparison of Aprotinin and Lysine Analogues in High-Risk Cardiac Surgery

Mécanisme



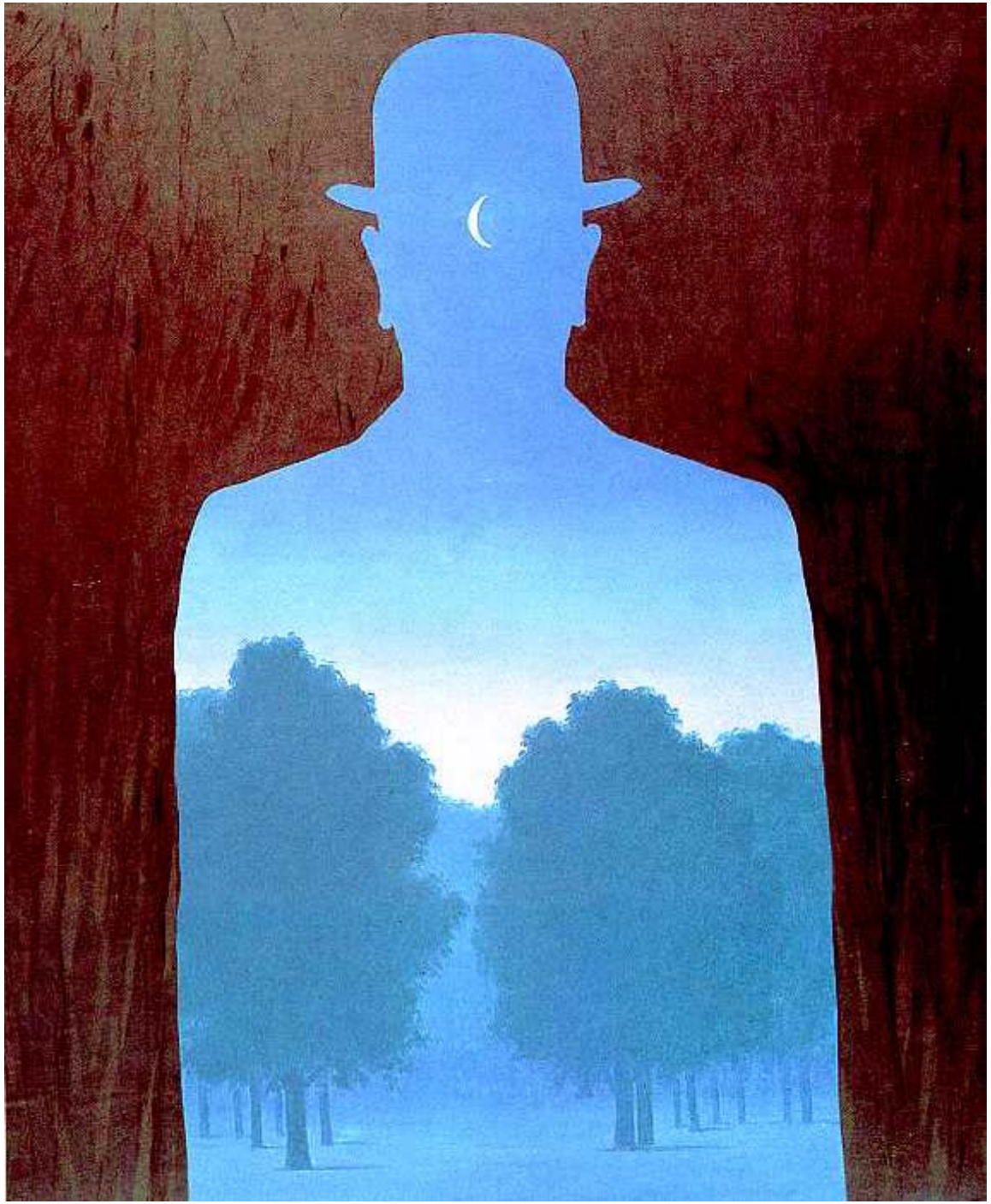
Approche

Mécanismes

- Déterminants du transport d'O_2
- Concept du retour veineux
- Courbes pression-Volume

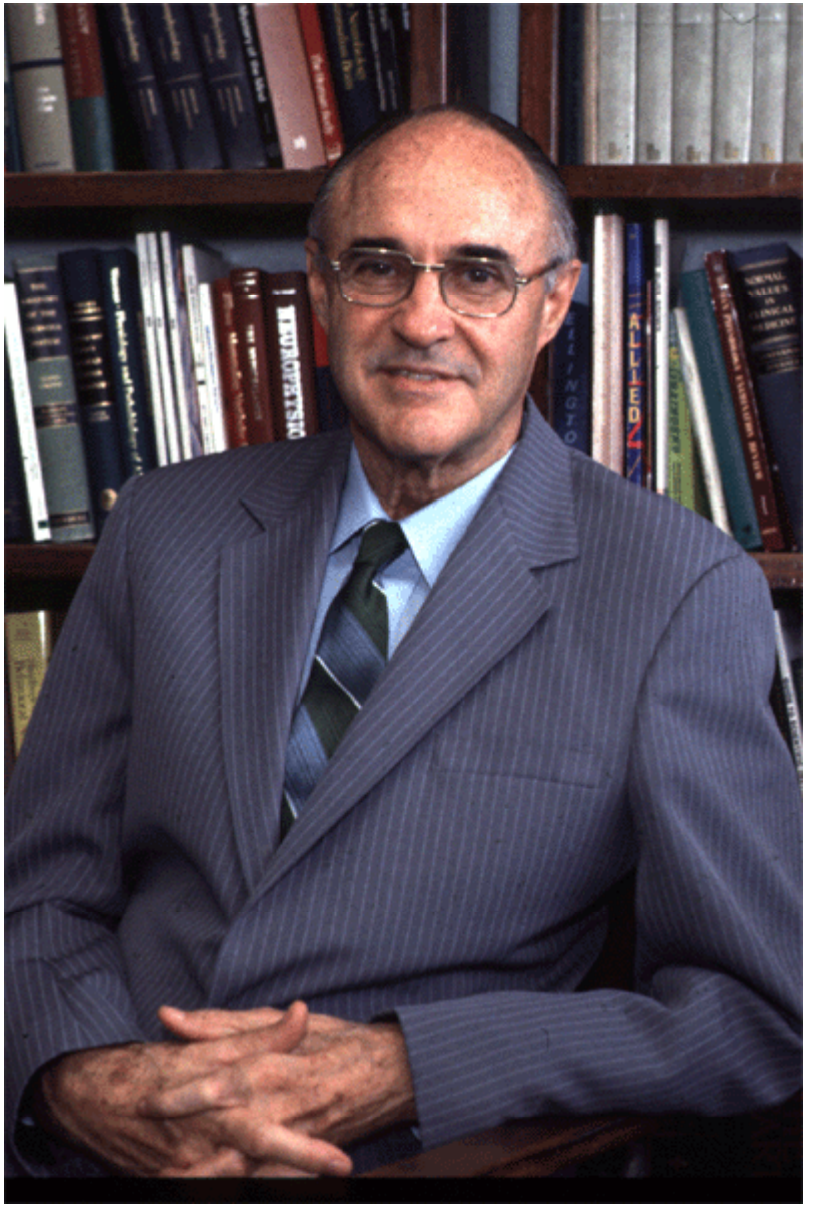
Tools in the diagnosis

- History and physical
- EKG
- Pulse oximetry
- Pressure waveforms
- Capnography
- Bedside echocardiography
- Others: labs, brain oximetry, Hb monitoring, thermodilution-derived CO



Magritte

Arthur C. Guyton



1919 - 2003

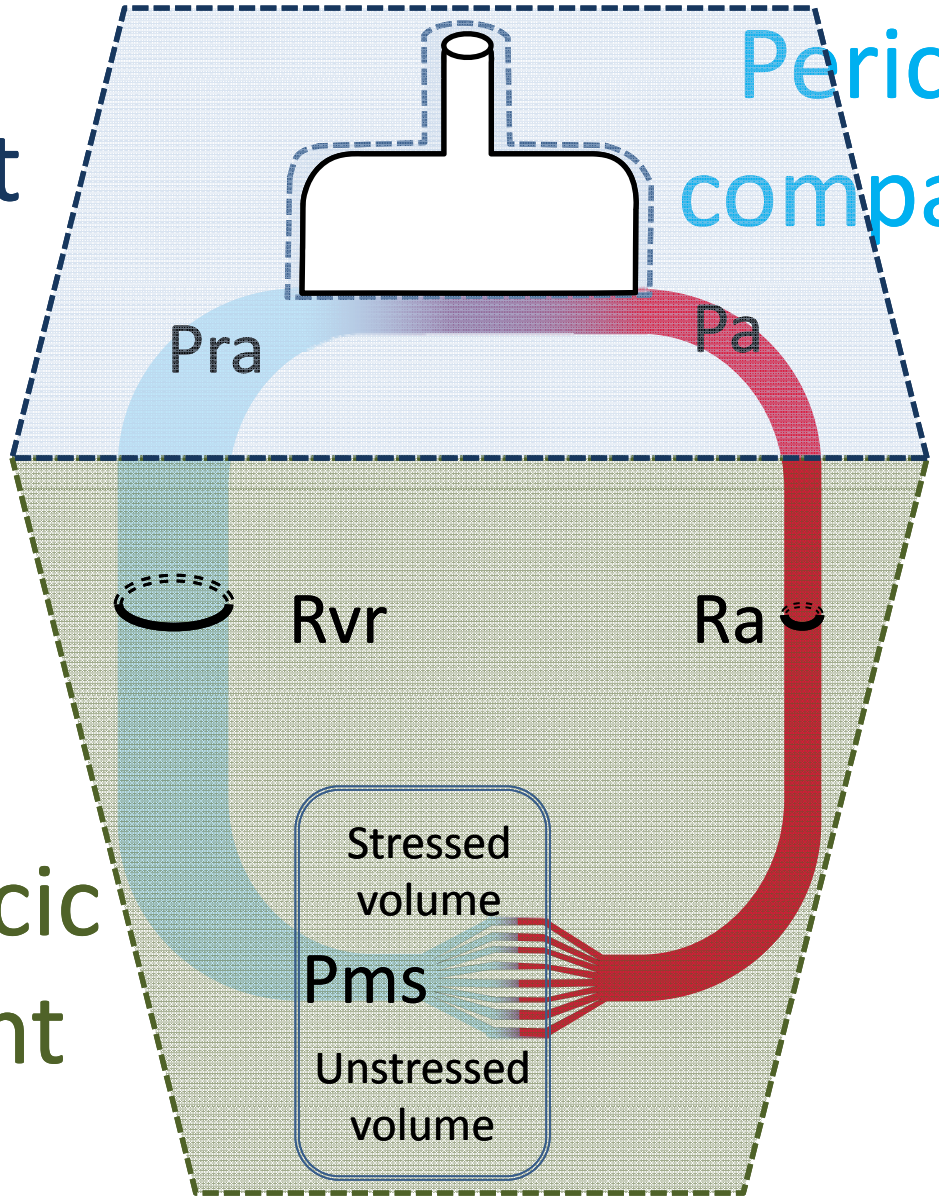
Eric Jacobsohn MB CHB FRCPC,*
Robin Chorn BSc MB CHB FRCPC,†
Michael O'Connor MD*

Review Article

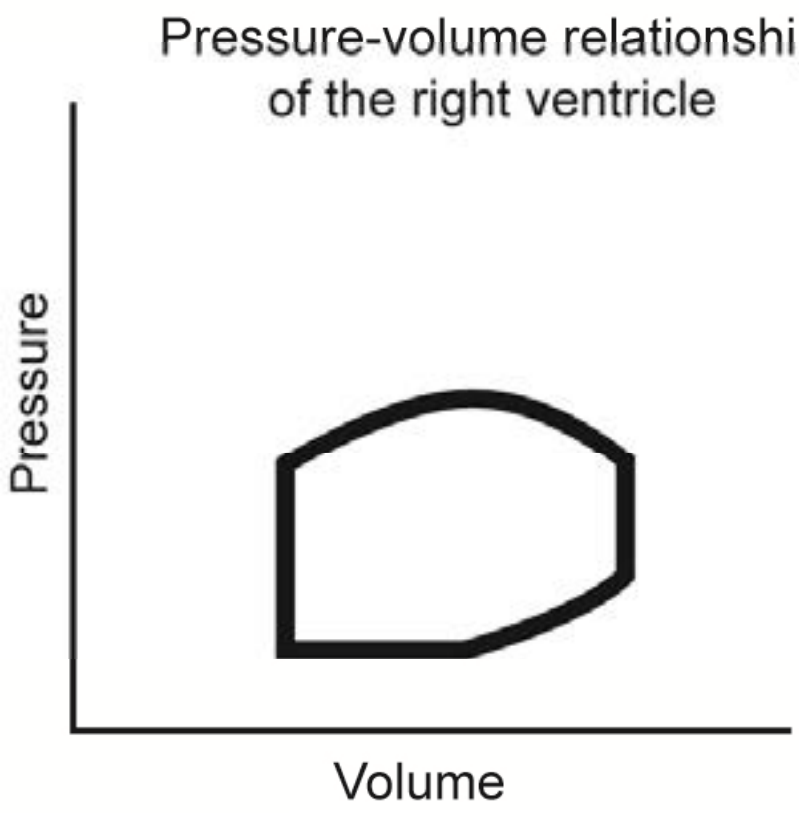
The role of the vasculature in regulating venous return and cardiac output: historical and graphical approach

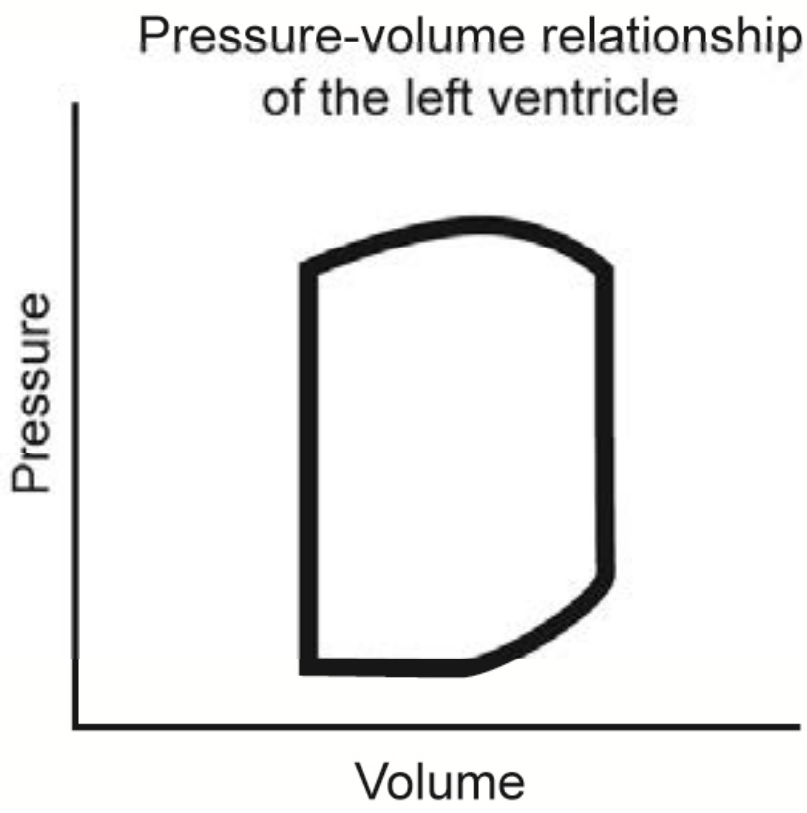
CAN J ANAESTH 1997 / 44: 8 / pp 849–867

Intrathoracic compartment



Extratrathoracic compartment


Pressure-volume relationship
of the right ventricle
Pressure
Volume


Pressure-volume relationship
of the left ventricle
Pressure
Volume

Déterminants du retour veineux

$$RV = \frac{\text{Gradient de pression}}{\text{Résistance au RV}} = \frac{Pvs - Pod}{Rrv}$$

1-↓ Pms: hypovolemia, vasodilatation

2-↑ Pra: Left and right systolic dysfunction
Left and right diastolic dysfunction
Left and right outflow tract obstruction
Pulmonary emboli
Hypoxia and hypercapnia

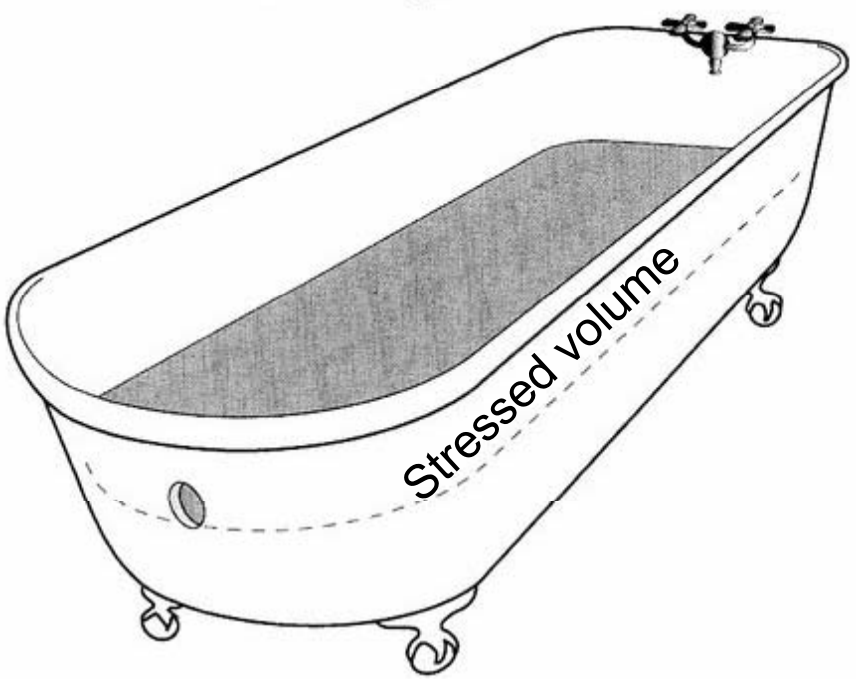
3-↑ Rrv: intrinsic obstruction and compartment syndrome (pericardial, mediastinal, thoracic, abdominal)

Intensive Care Med (1998) 24: 651–653

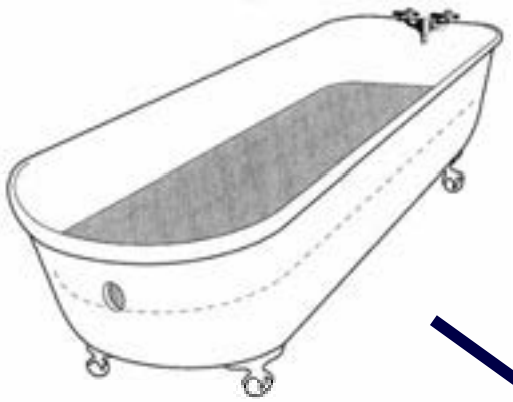
EDITORIAL

S. Magder

More respect for the CVP

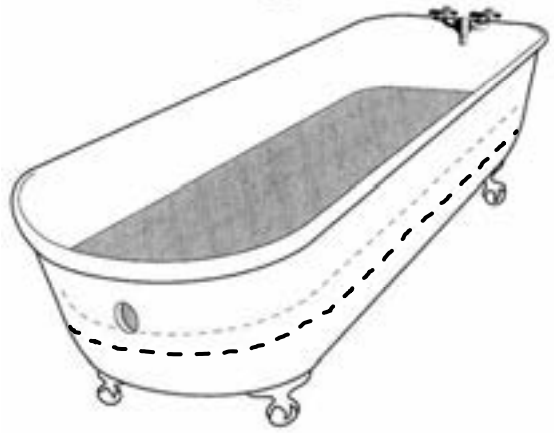


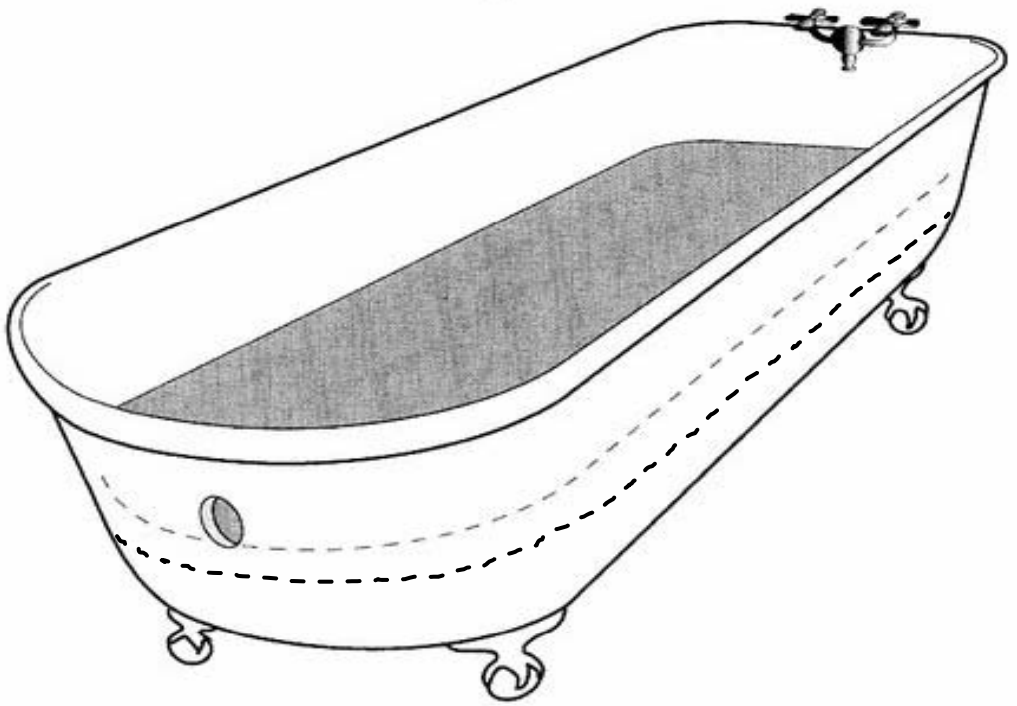
Pms = $\frac{\text{Stress volume}}{\text{Compliance}}$



Loss of
"stress volume"

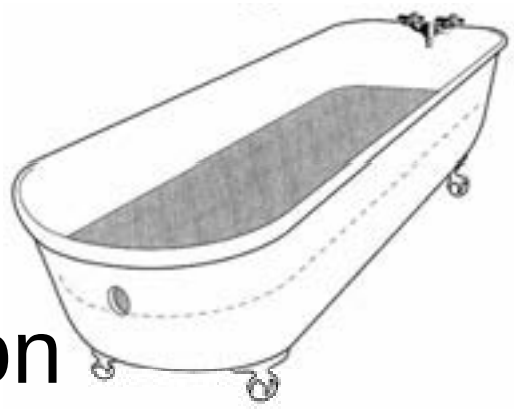
Increase in
"unstress volume"
or compliance

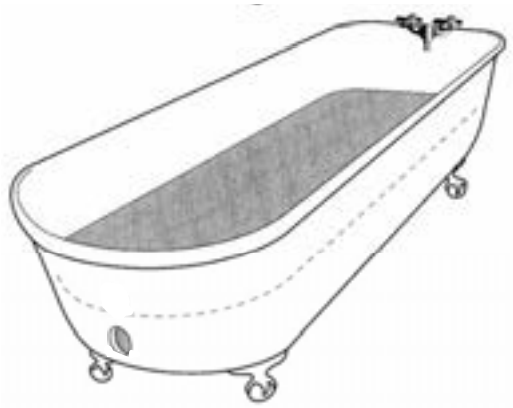




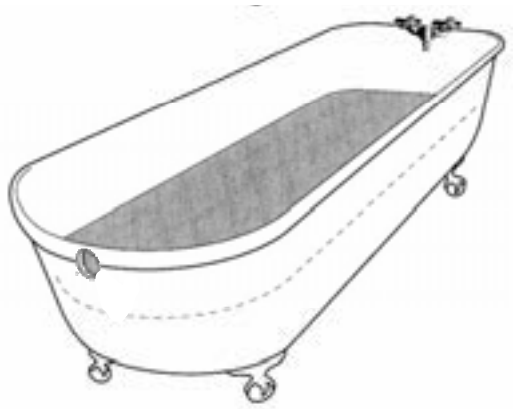
Adapated from: Jacobsohn et al Can J Anesth 1997 44:8 849-67

↑ Cardiac function

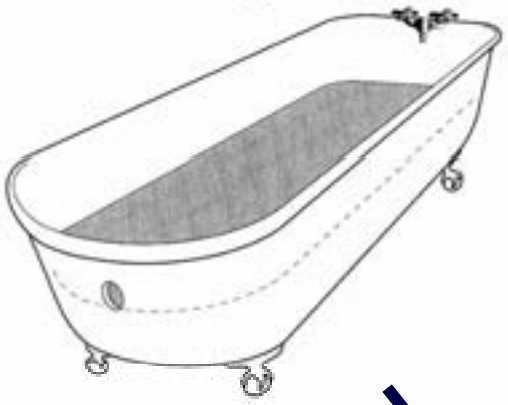




↓ Cardiac function:
↑ Right atrial pressure

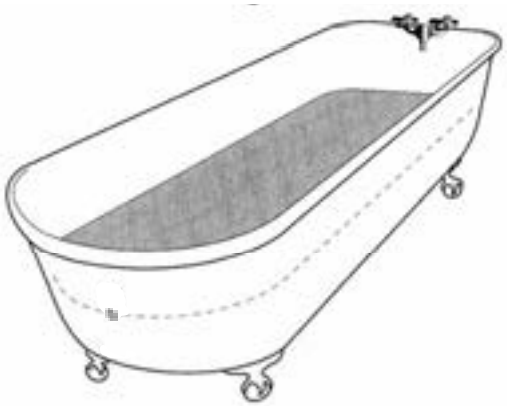


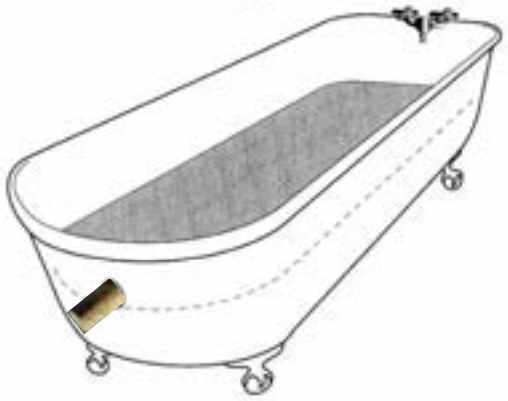
Adapated from: Jacobsohn et al Can J Anesth 1997 44:8 849-67



↓ size of
the opening

Obstruction
of the opening



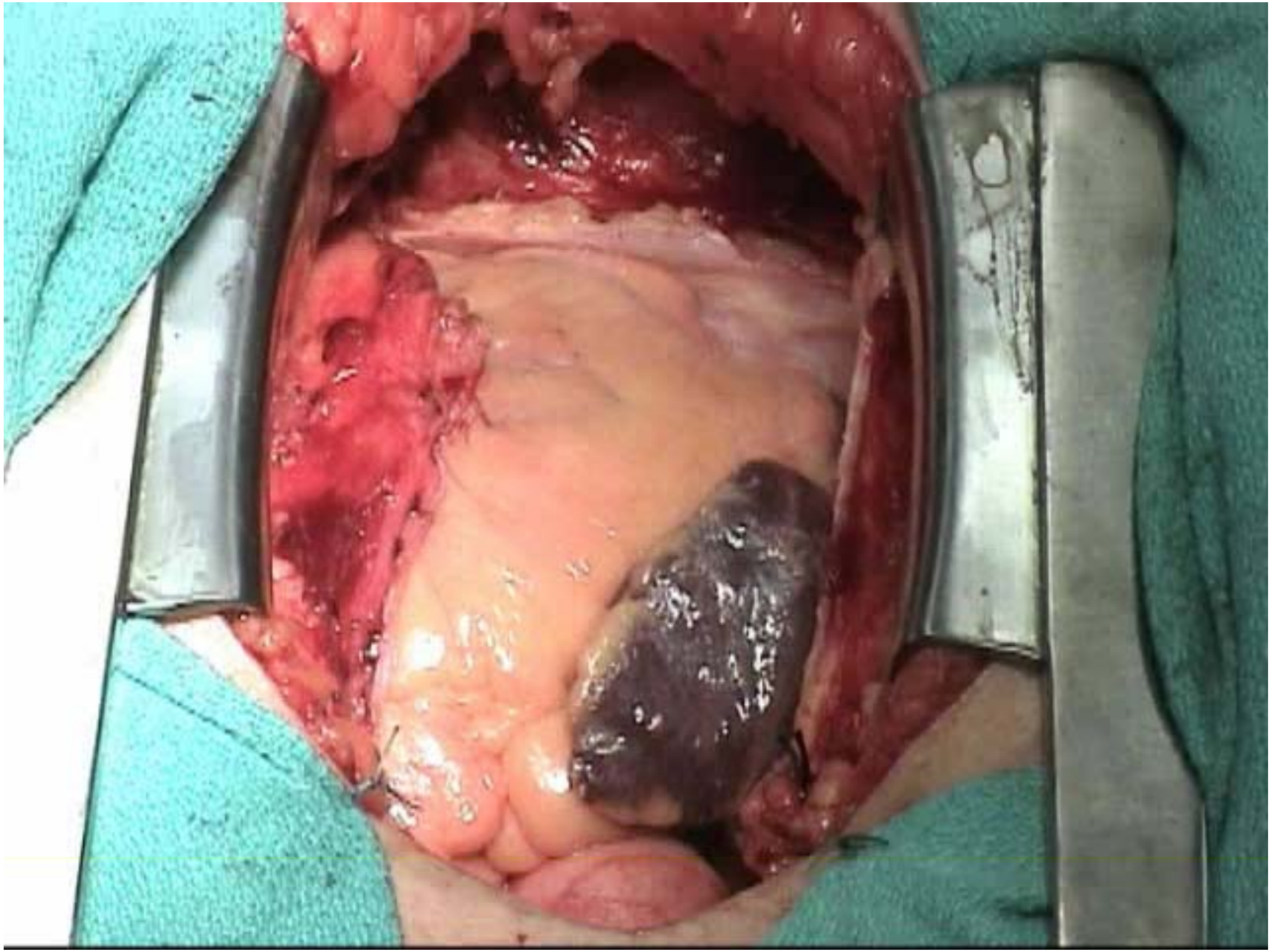


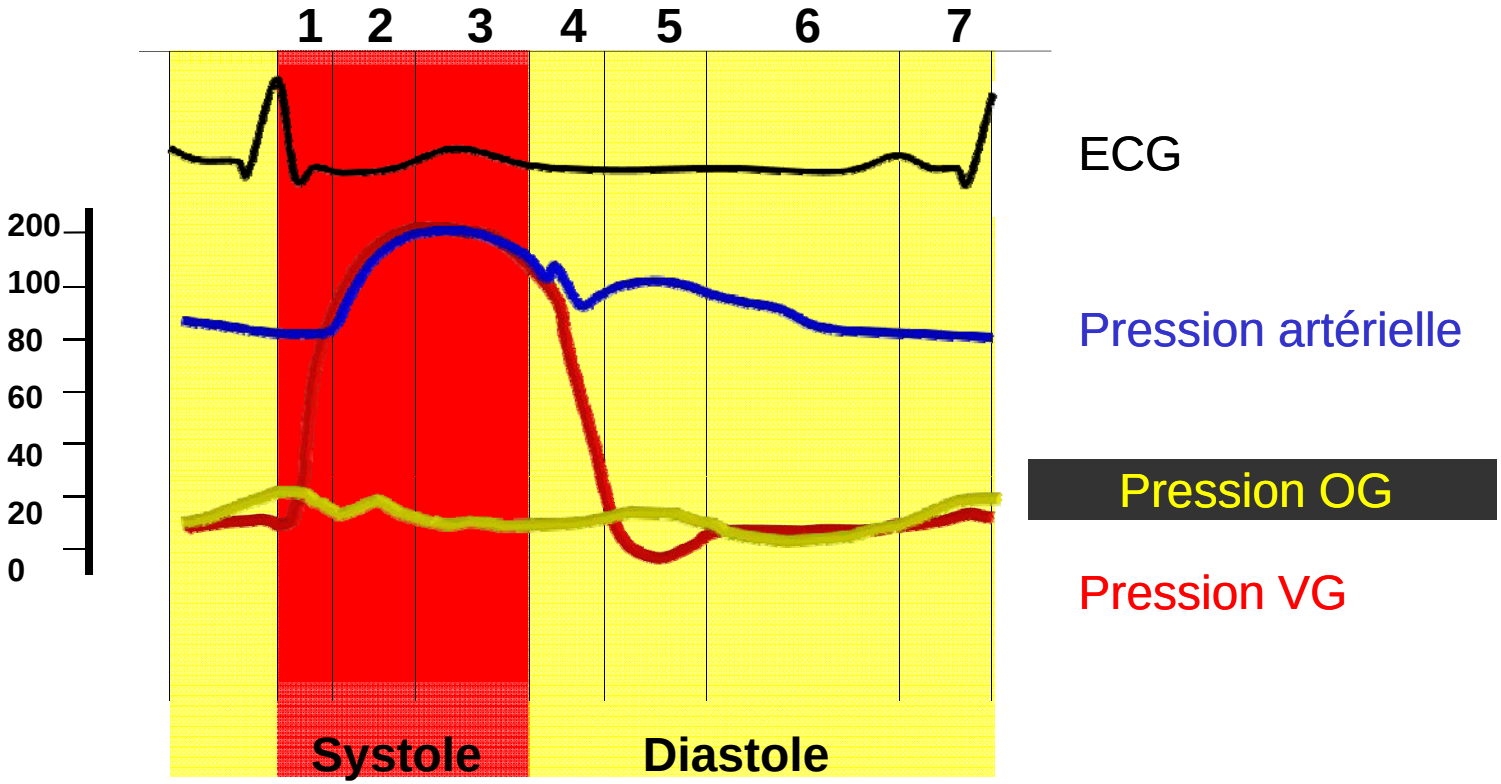
Adapated from: Jacobsohn et al Can J Anesth 1997 44:8 849-67

Shock state

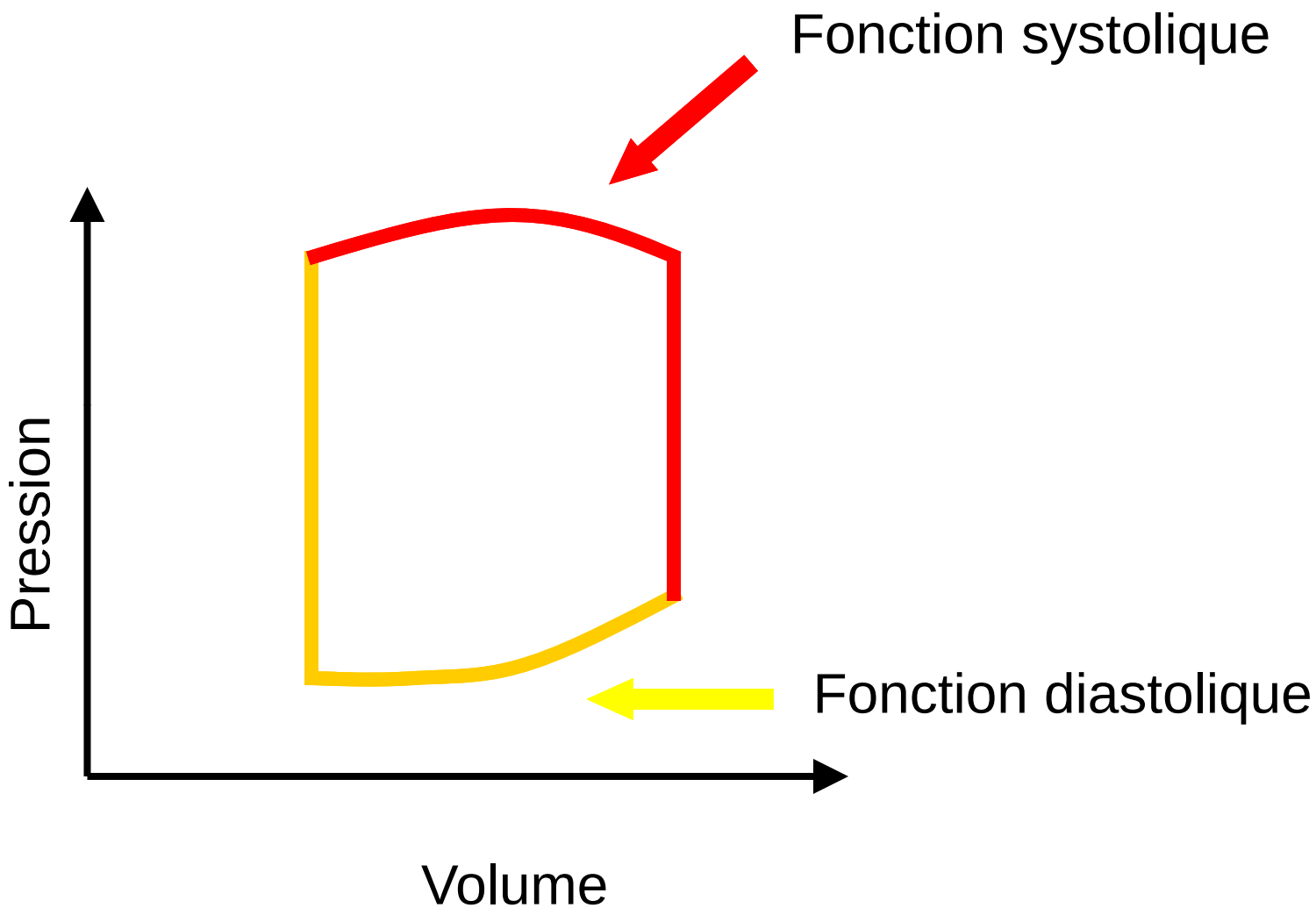
Hypotension
Oliguria
Cold extremities
Neurological alteration
Acidosis

If Guyton would have done peri-operative echocardiography, what would have been his observations?

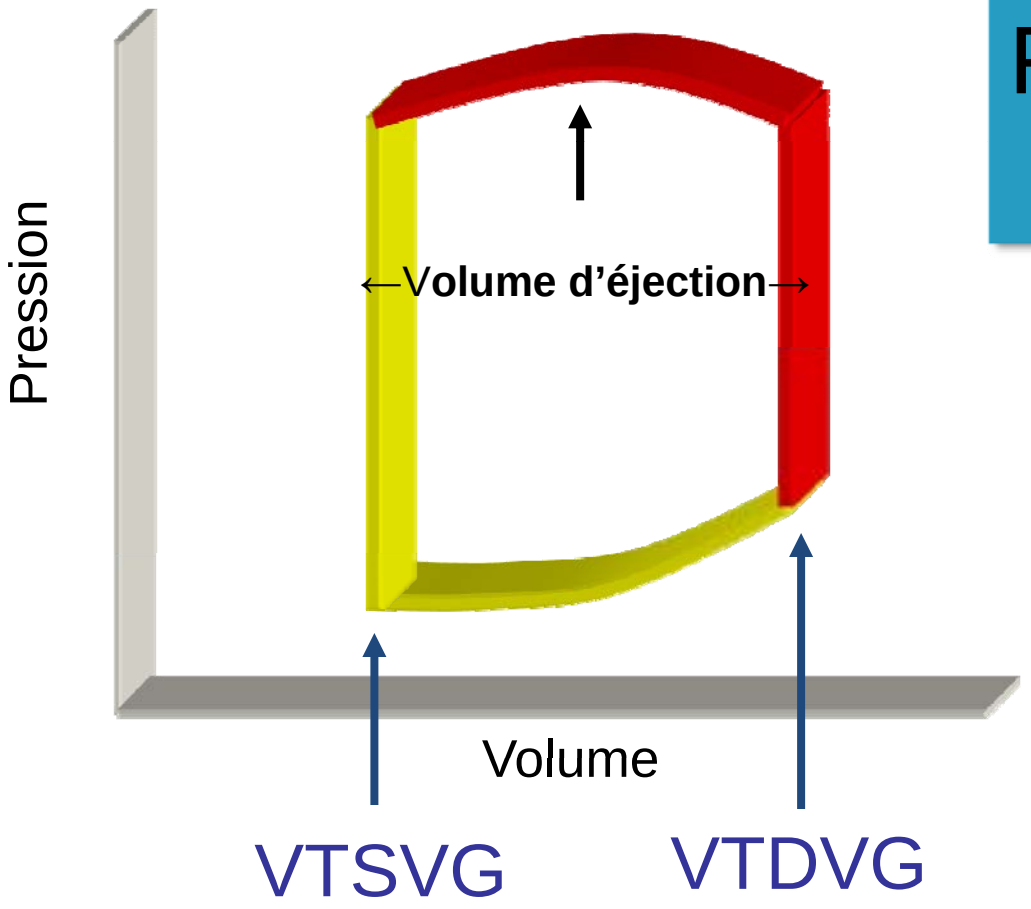




Adapted from Bettex D. Échocardiographie transoesophagienne en anesthésie-réanimation 1997


Fonction systolique
Pression
Fonction diastolique
Volume

Courbe pression-volume



$$FEVG = \frac{VE}{VTDVG}$$

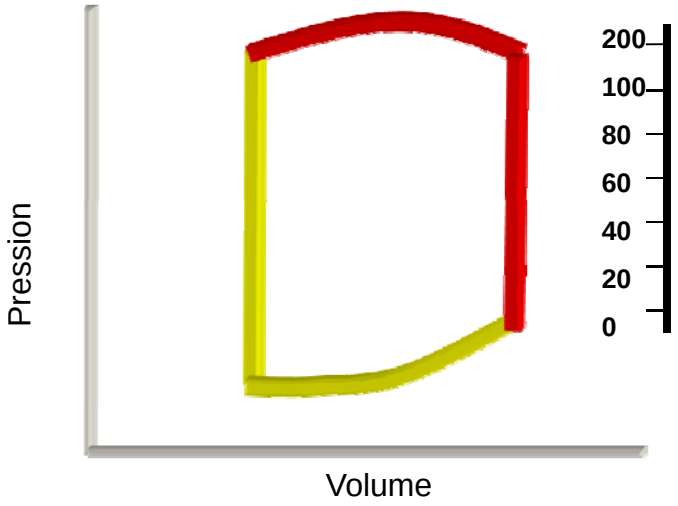
$$FEVG = \frac{VE}{VTDVG}$$

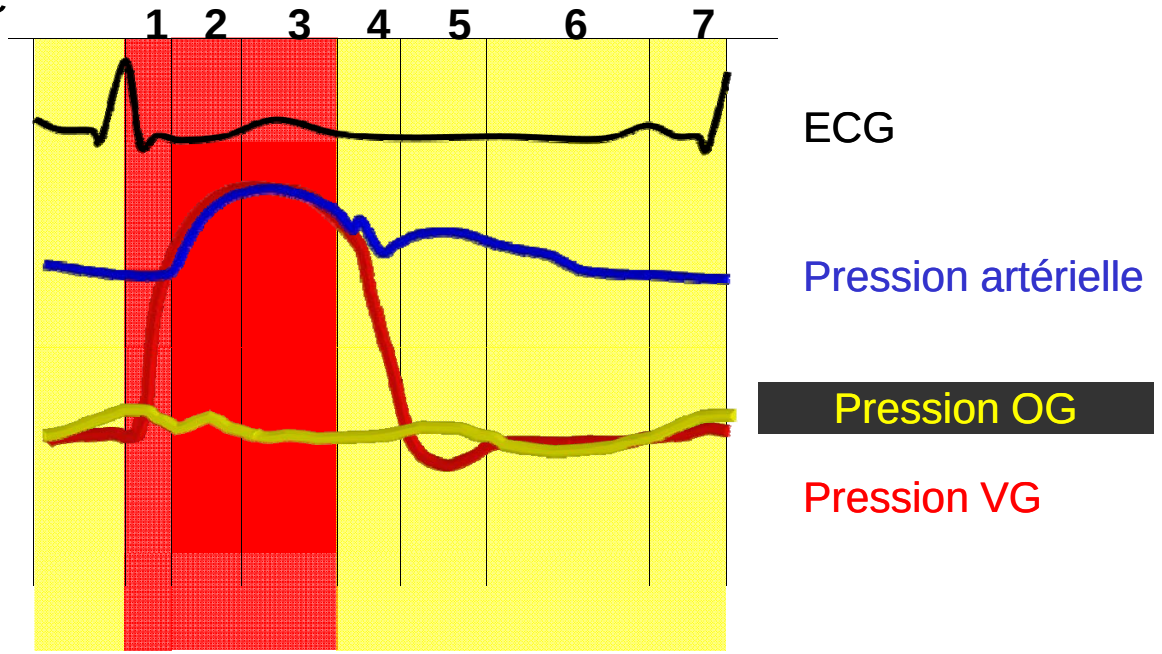
$$VE = FEVG \times VTDVG$$

Performance cardiaque → Fonction systolique

Remplissage → Fonction diastolique

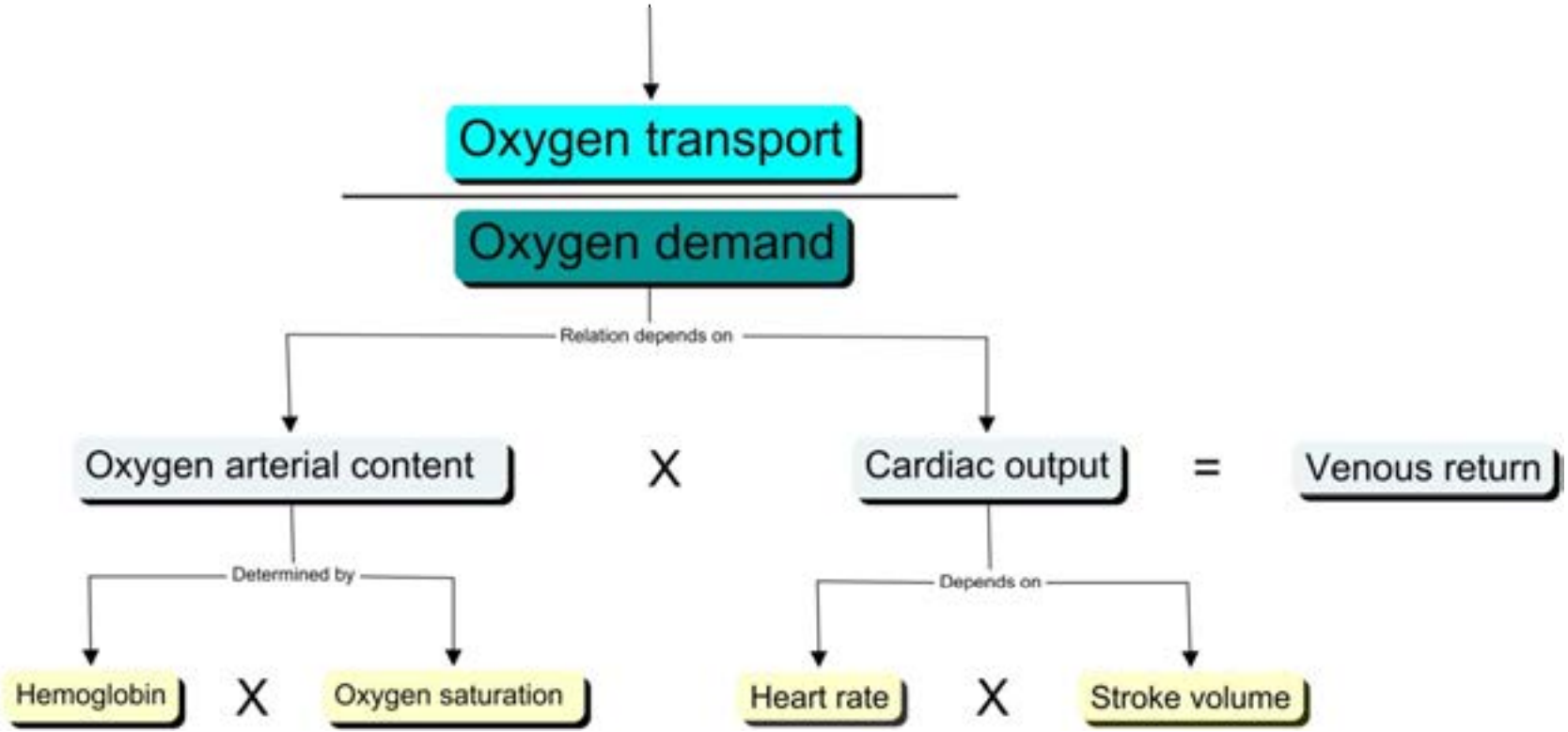
Courbe pression-volume



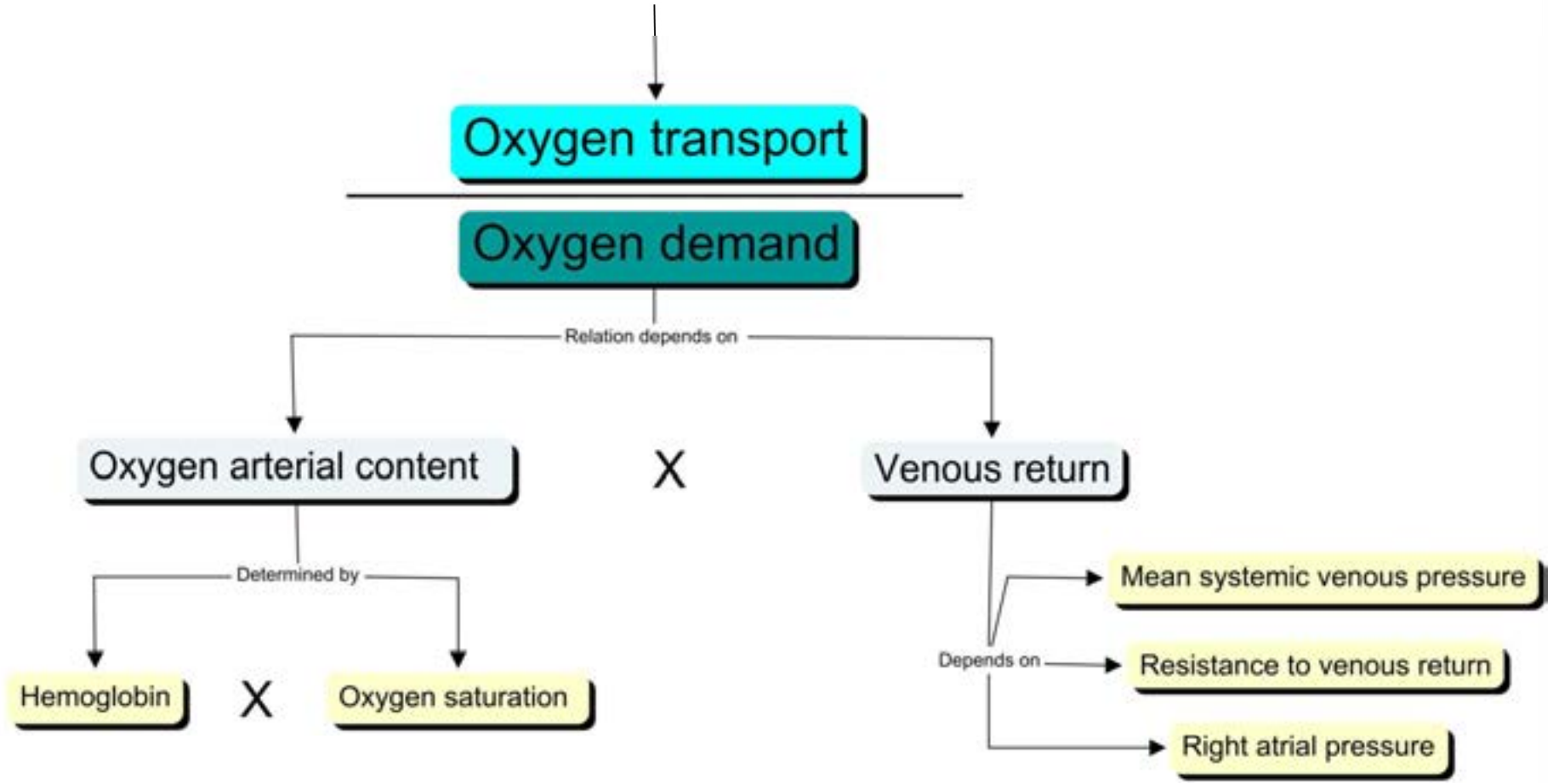


Adapted de Bettex D. Échocardiographie transoesophagienne en anesthésie-réanimation 1997

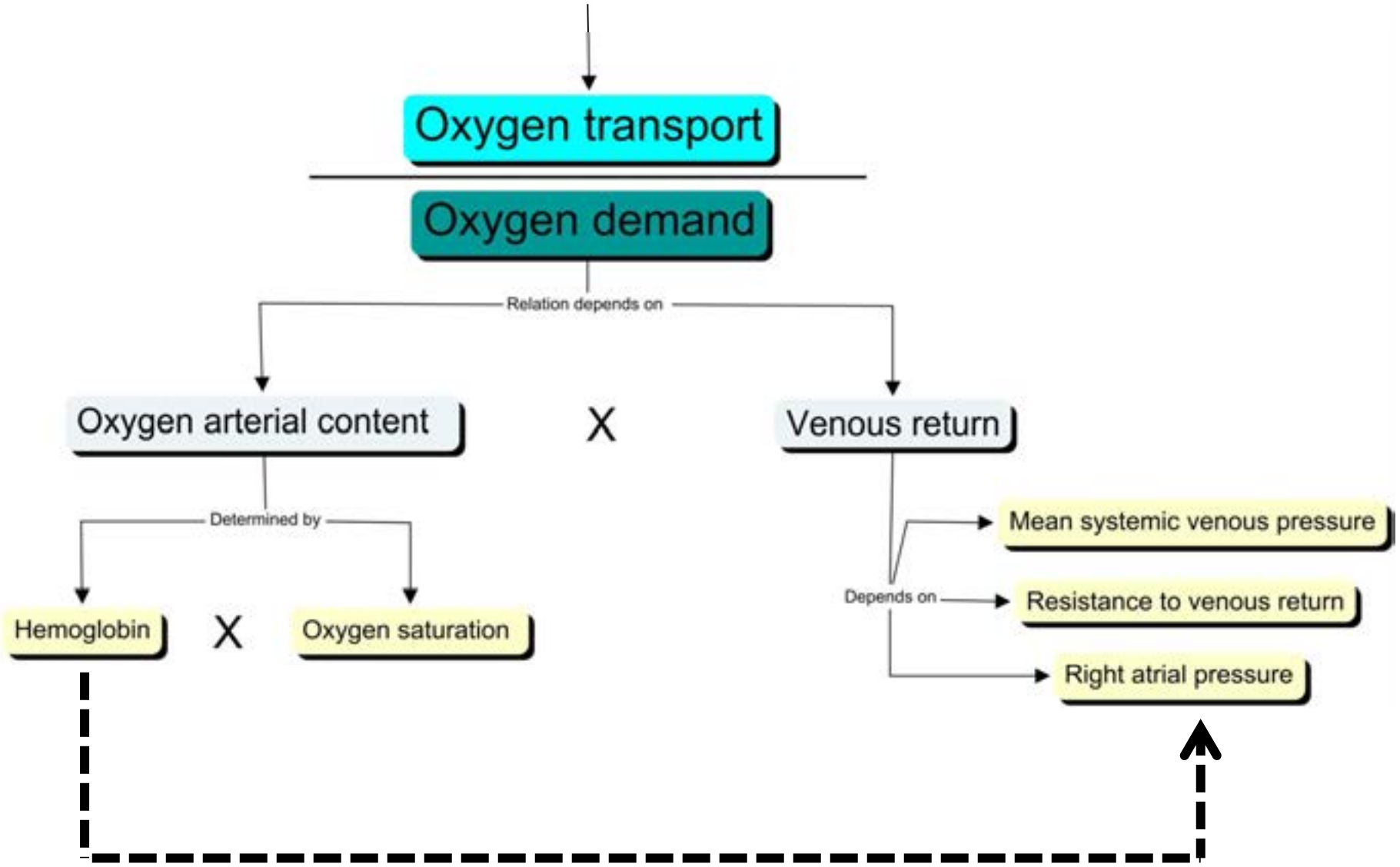
Choc cardiogénique



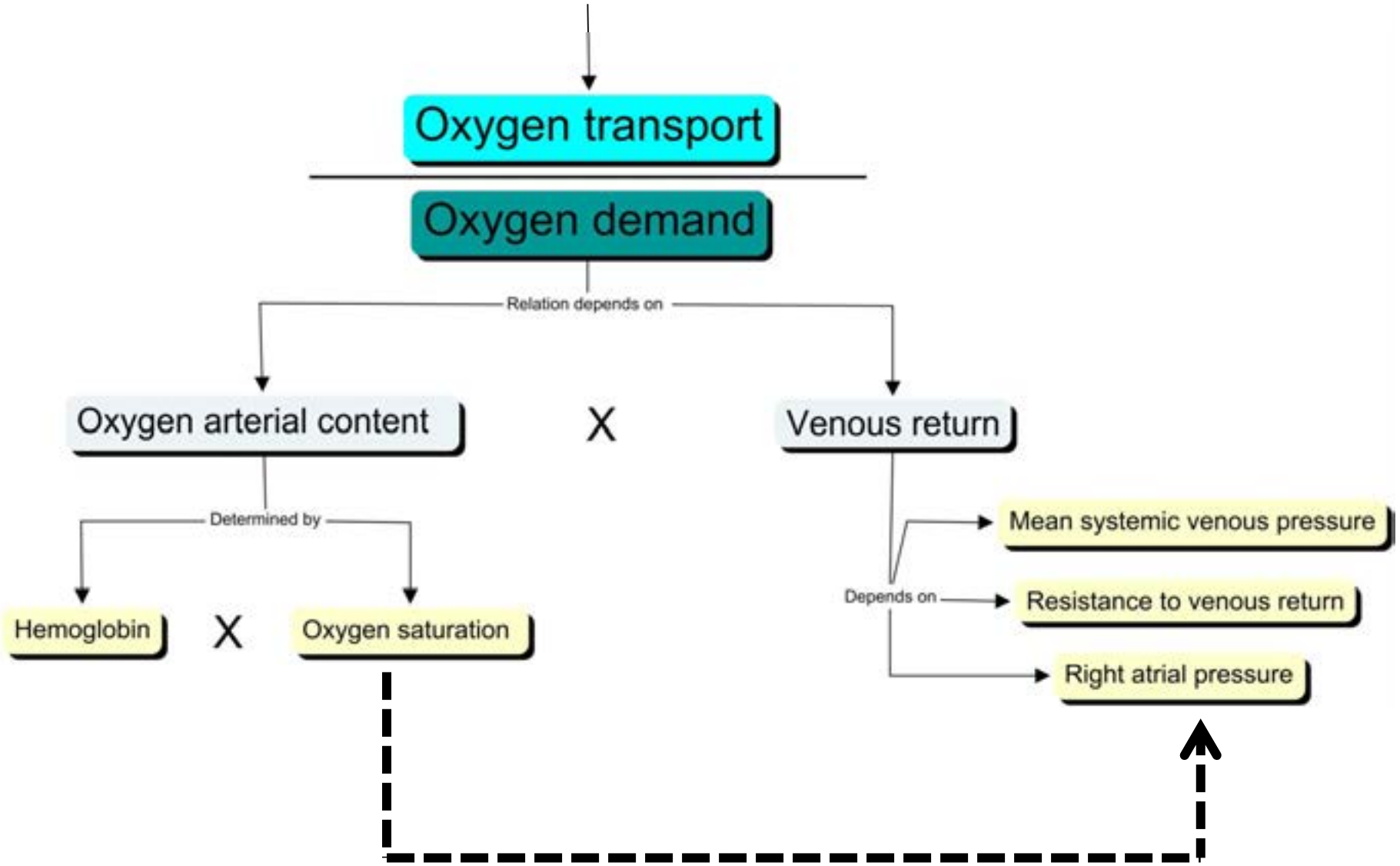
Choc cardiogénique



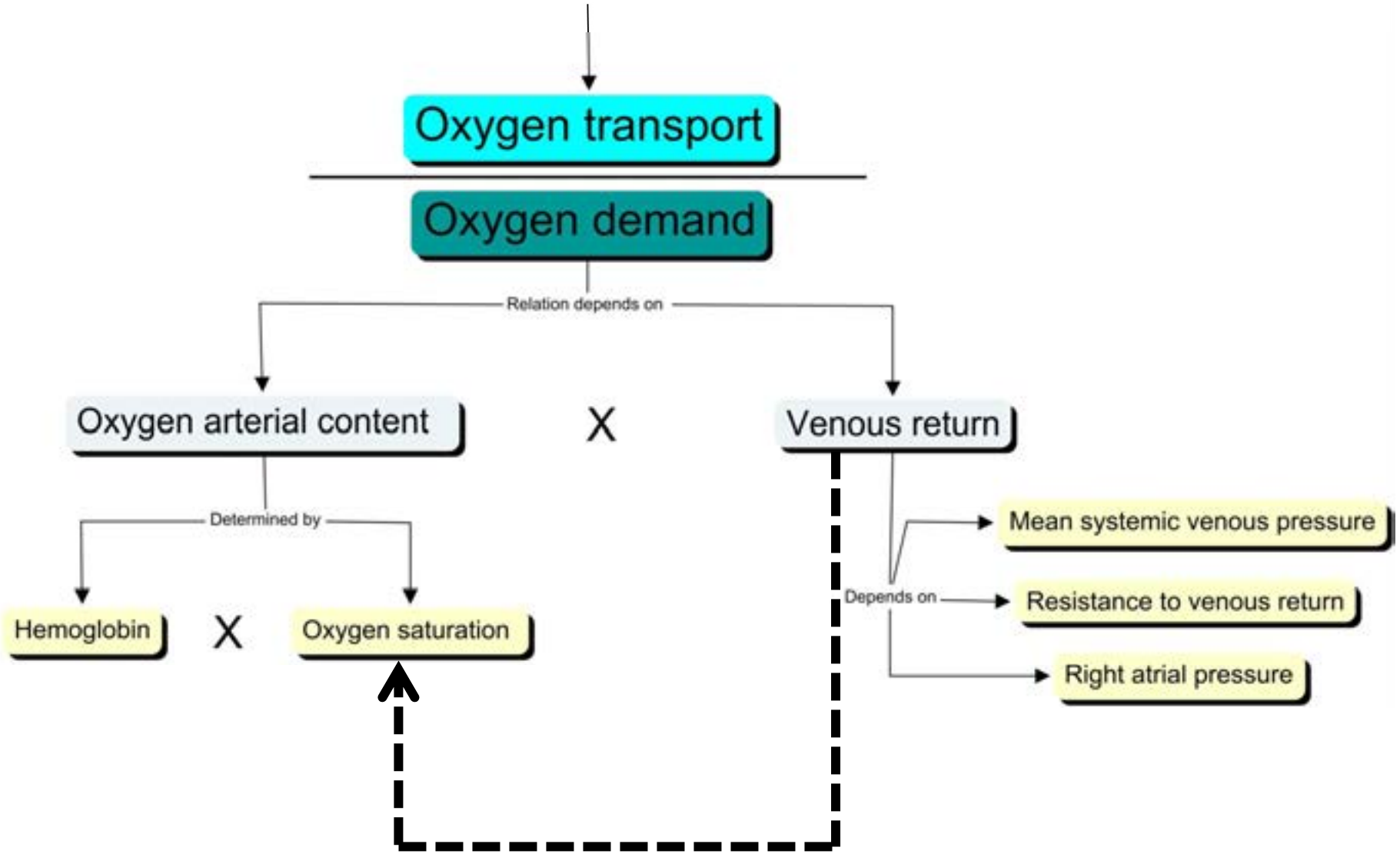
Choc cardiogénique



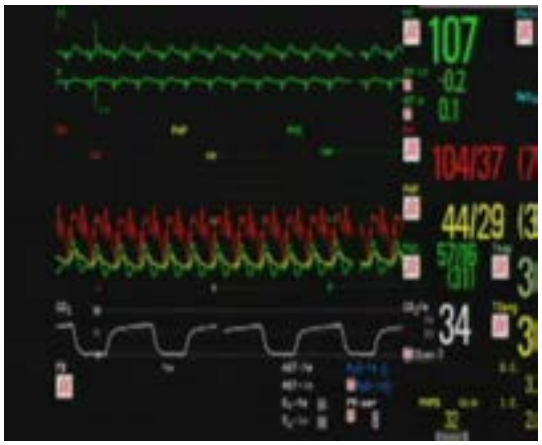
Choc cardiogénique



Choc cardiogénique



Définition

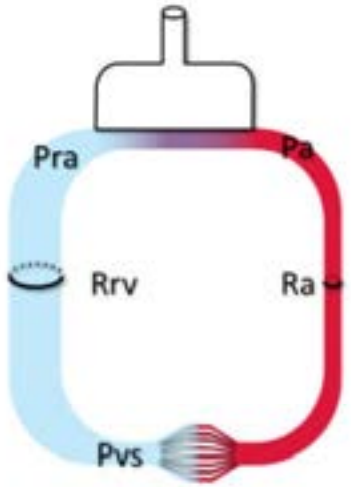


Importance

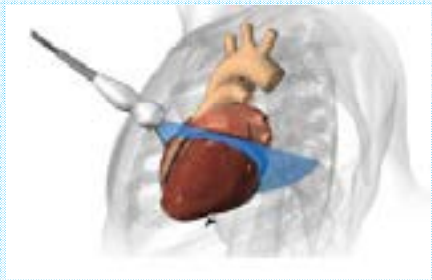

The NEW ENGLAND JOURNAL of MEDICINE

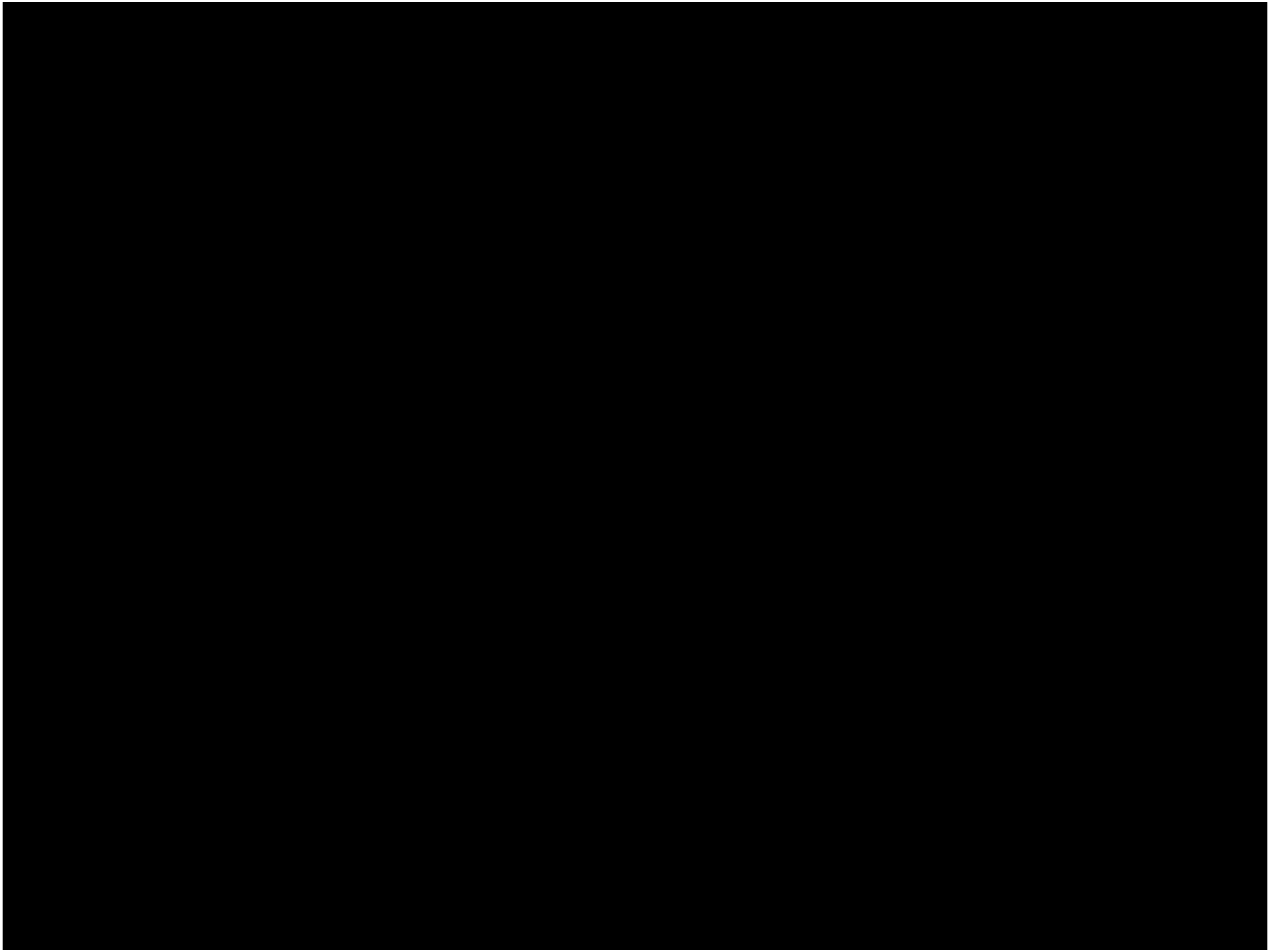
A Comparison of Aprotinin and Lysine Analogues in High-Risk Cardiac Surgery

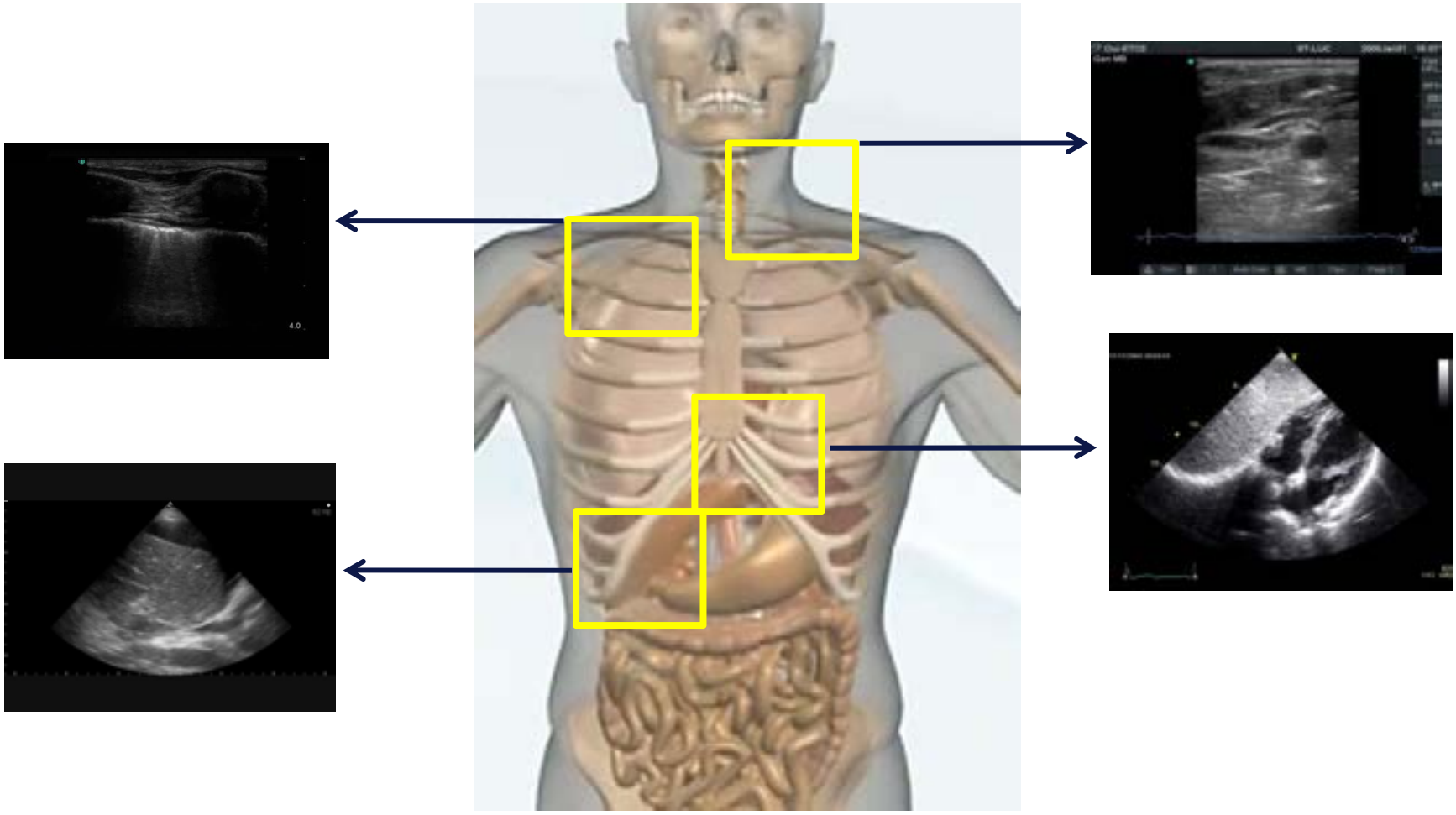
Mécanisme



Approche

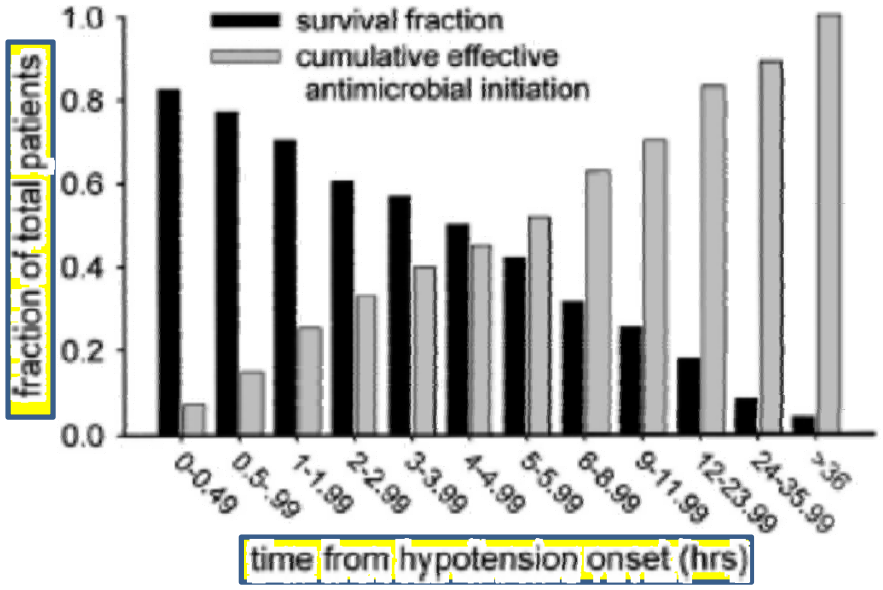






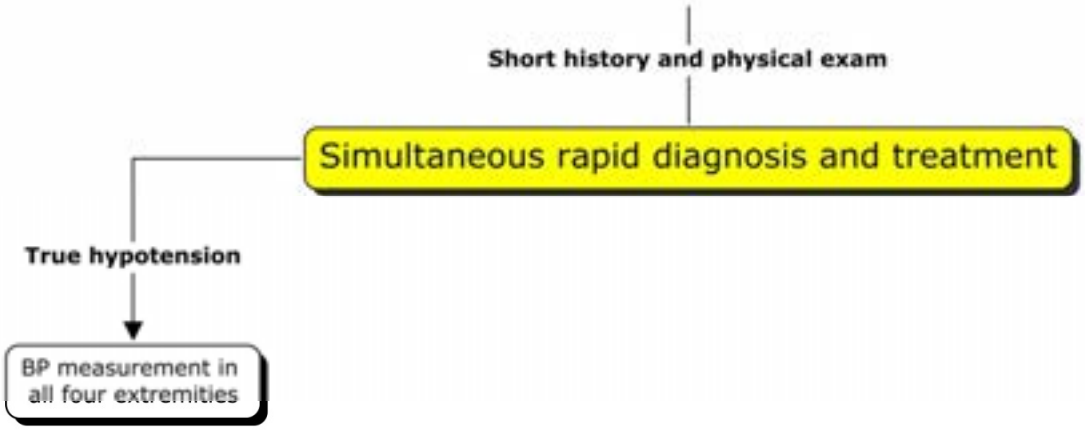
Duration of hypotension before initiation of effective antimicrobial therapy is the critical determinant of survival in human septic shock*

Anand Kumar, MD; Daniel Roberts, MD; Kenneth E. Wood, DO; Bruce Light, MD; Joseph E. Parrillo, MD; Satendra Sharma, MD; Robert Suppes, BSc; Daniel Feinstein, MD; Sergio Zanotti, MD; Leo Taiberg, MD; David Gurka, MD; Aseem Kumar, PhD; Mary Cheang, MSc



(Crit Care Med 2006; 34:1589–1596)

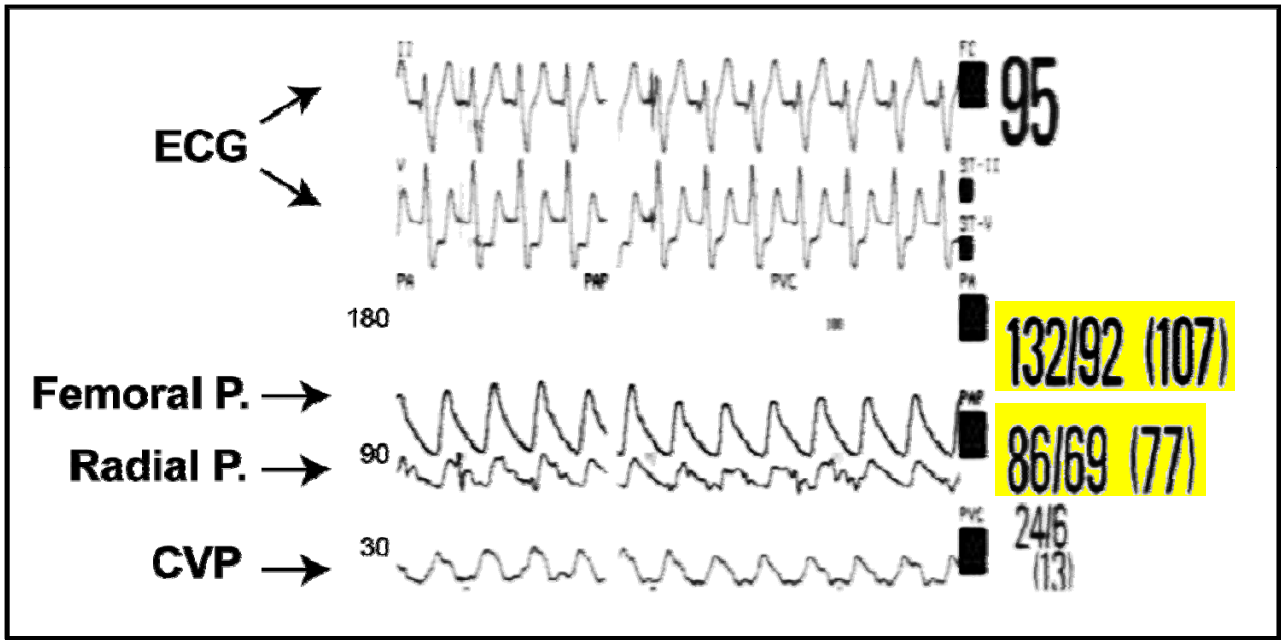
Choc cardiogénique



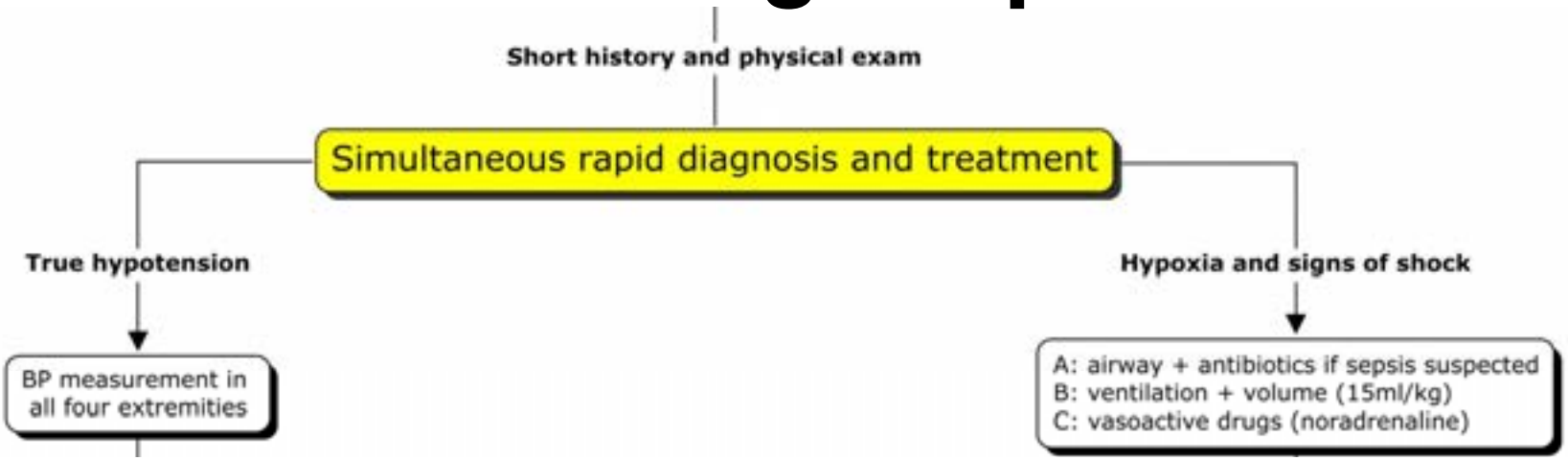

FC 48
FR
PA (91)
132/ 66
AP (13)
21/ 8
PVC(6)
P4A(94)
139/ 67
%SO2 100
PR 50
T1A
T1B33.5
DC 3.0
TS 33.1

Abnormal aortic-to-radial arterial pressure gradients resulting in misdiagnosis of hemodynamic instability

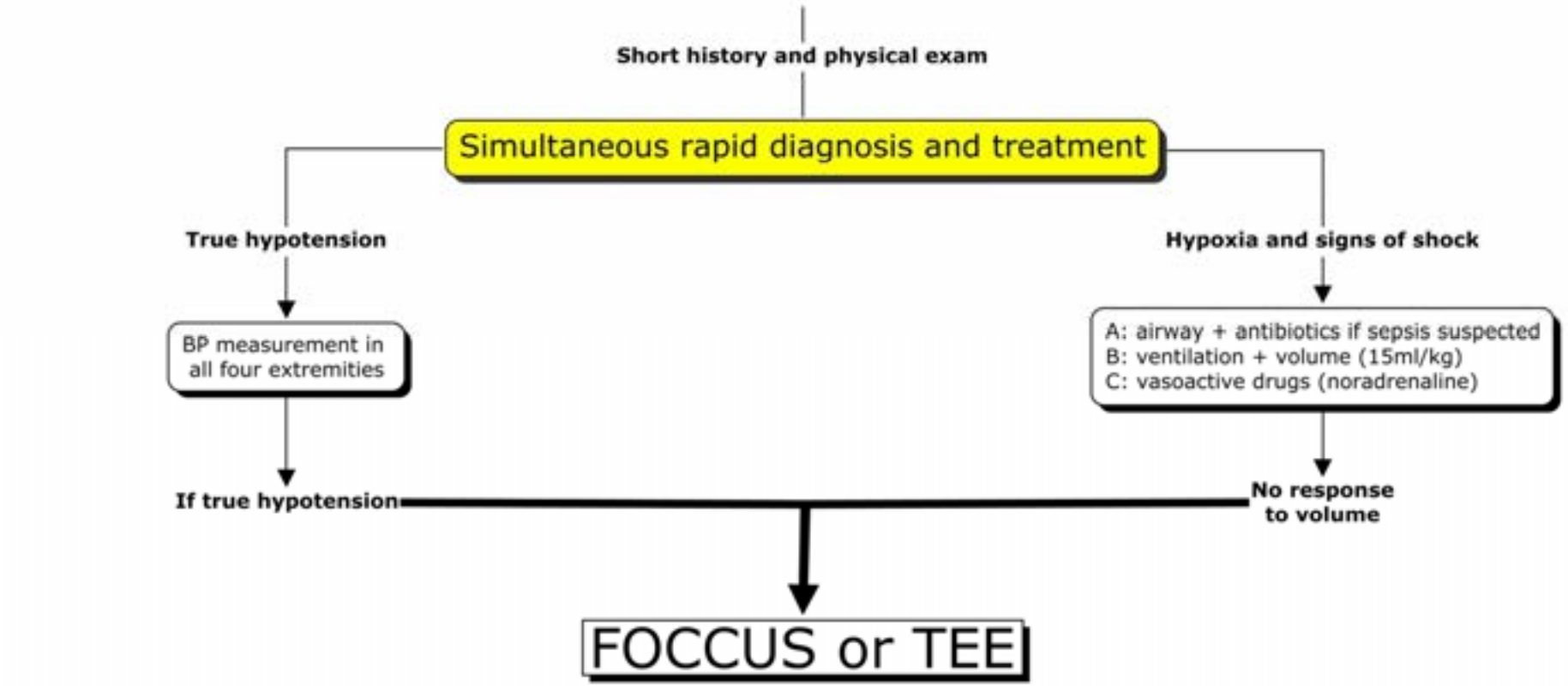
André Denault, MD · Alain Deschamps, MD, PhD



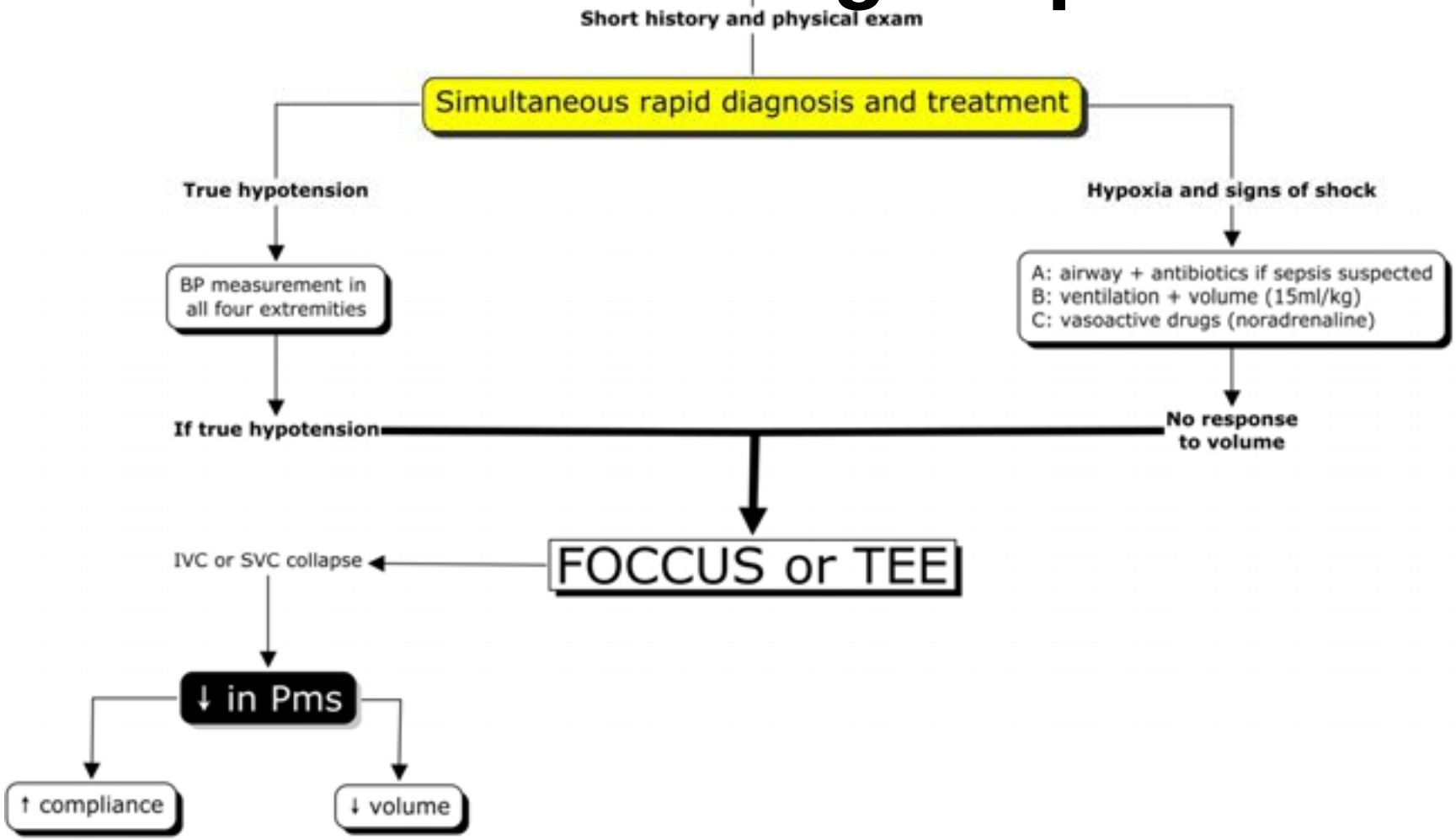
Choc cardiogénique



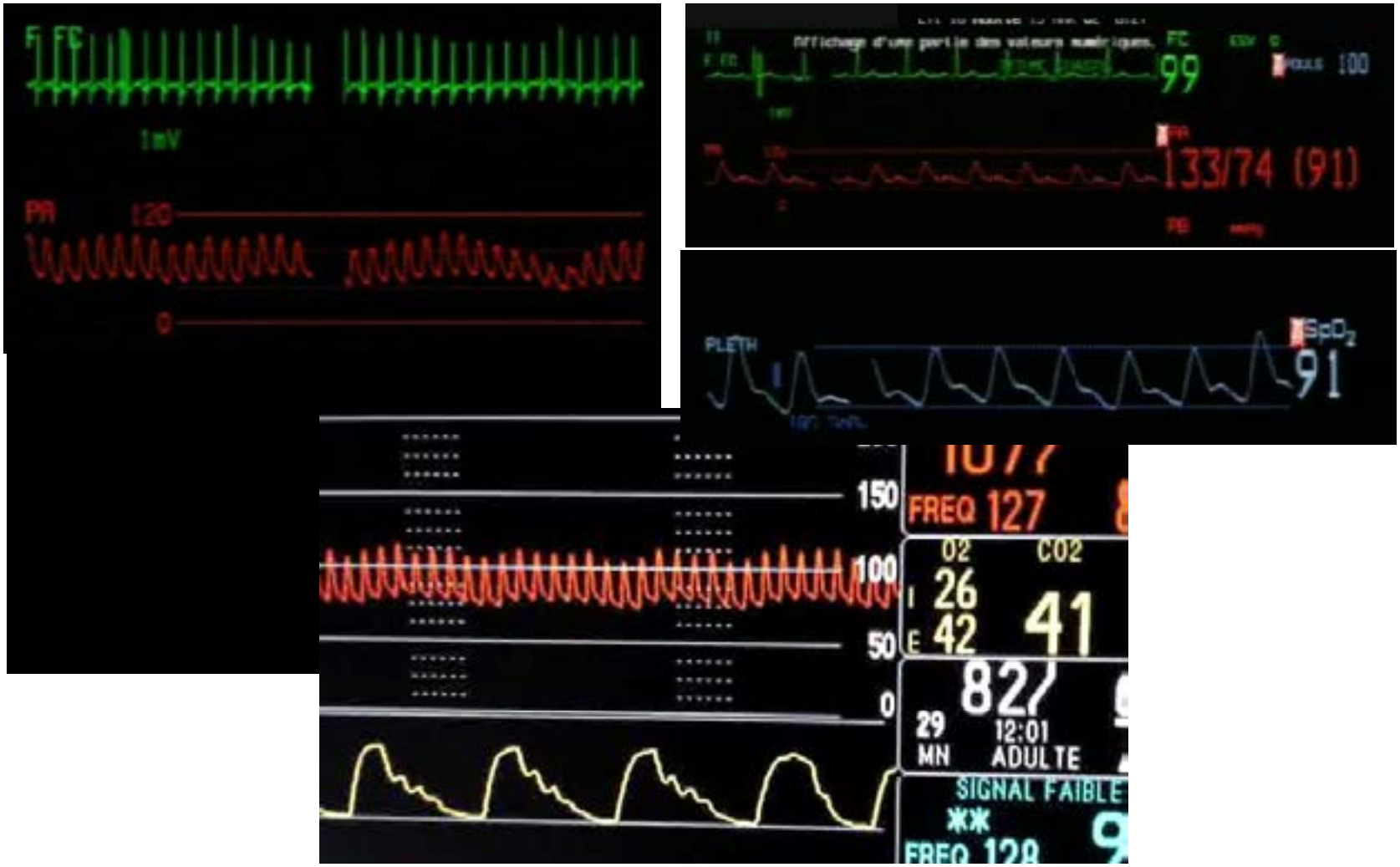
Choc cardiogénique



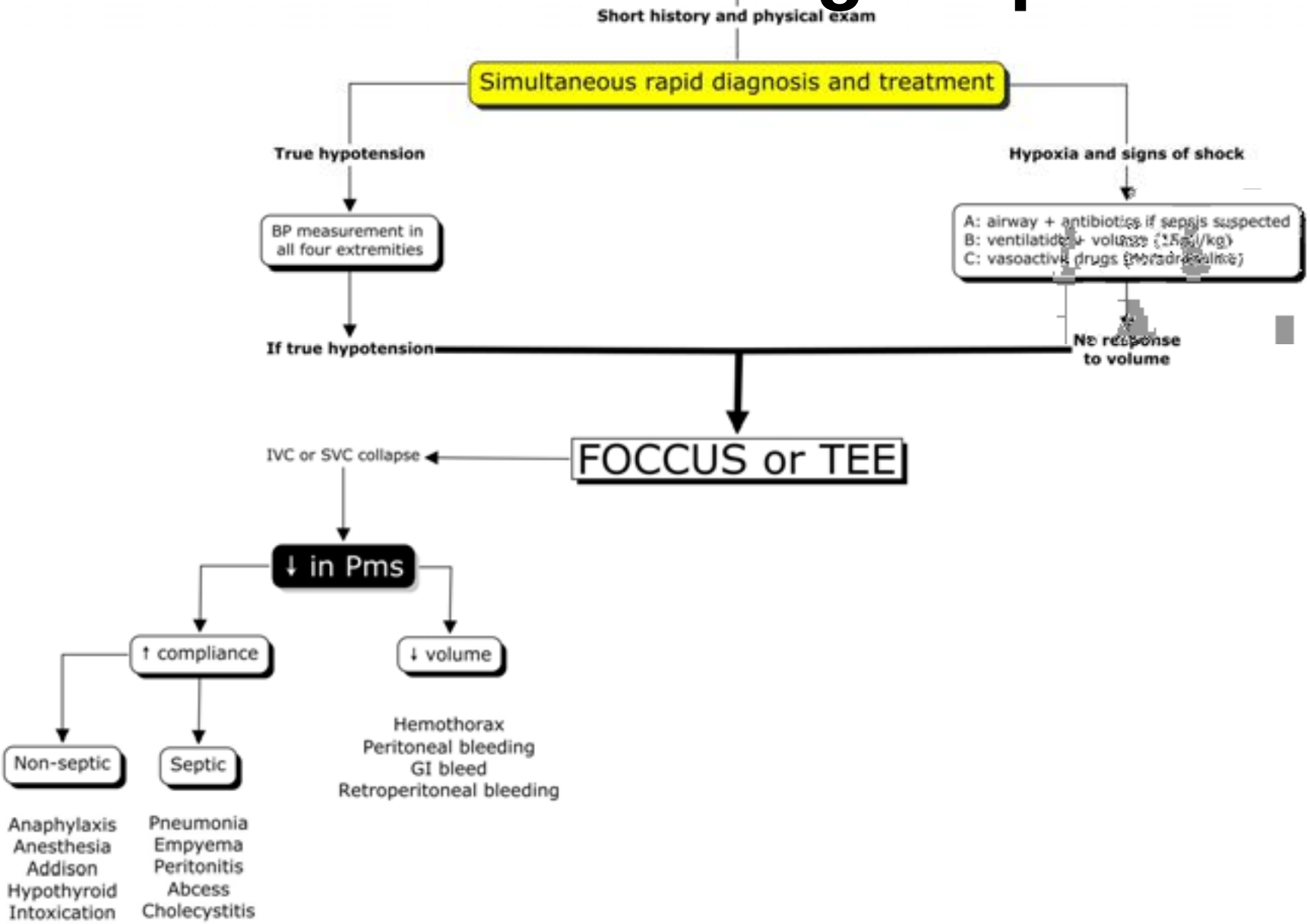
Choc cardiogénique



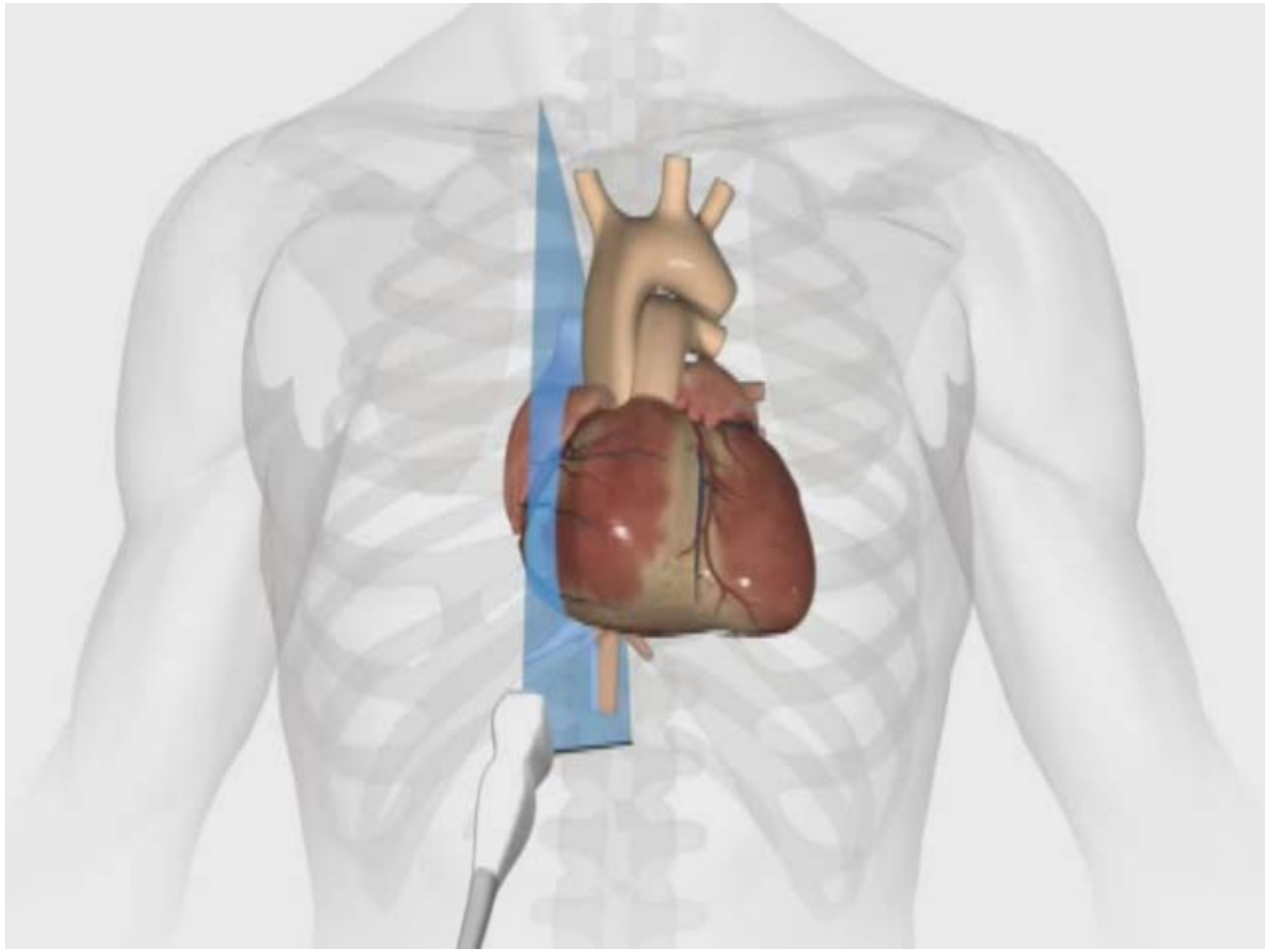
Evaluation of volume status



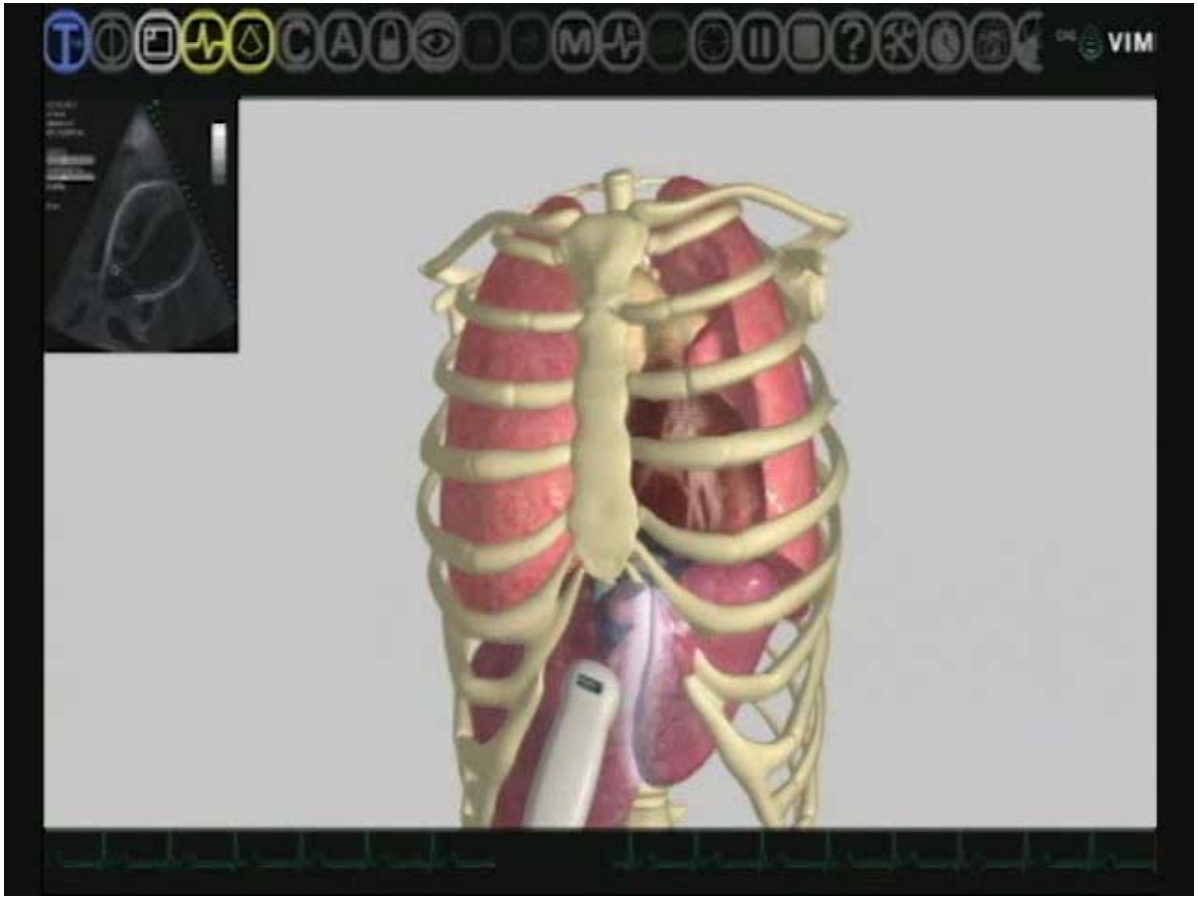
Choc cardiogénique

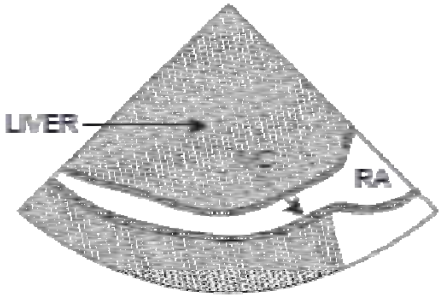


The 90°subcostal view

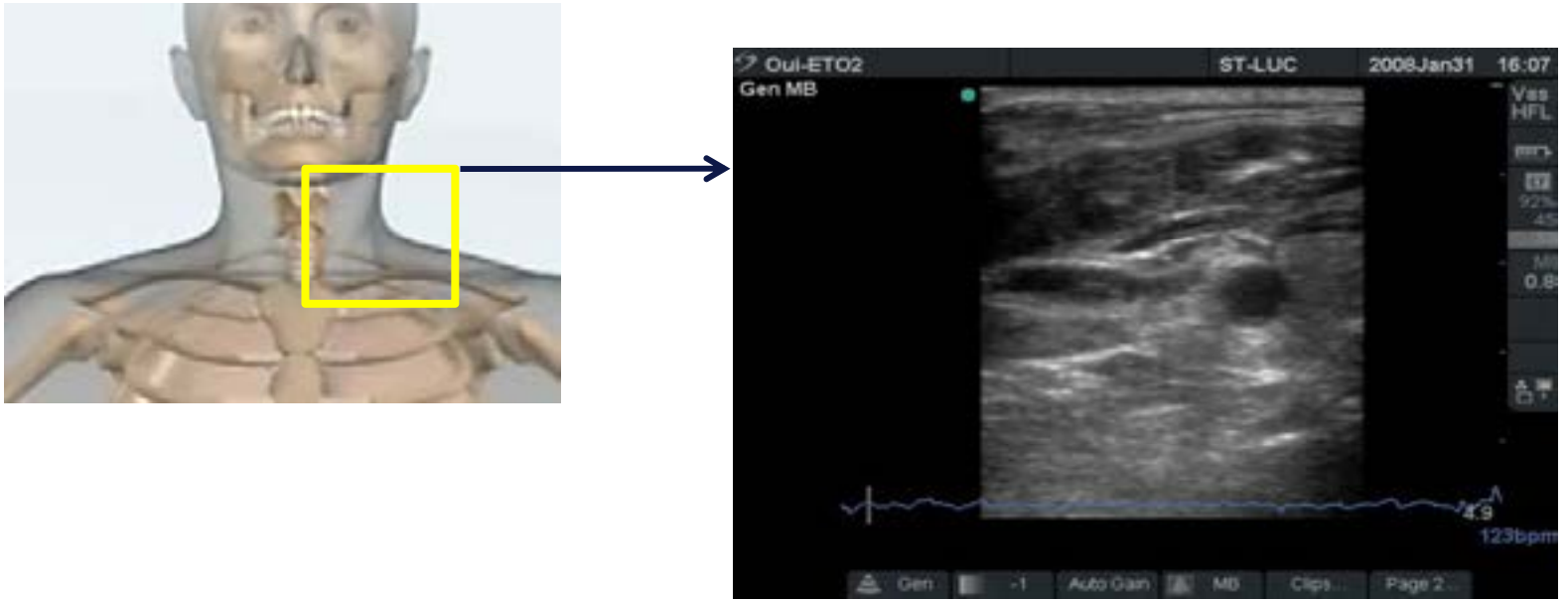


Normal or ↓ Pms





Normal or ↓ Pms



Passive leg raising predicts fluid responsiveness in the critically ill*

Xavier Monnet, MD, PhD; Mario Rienzo, MD; David Osman, MD; Nadia Anguel, MD; Christian Richard, MD; Michael R. Pinsky, MD, Dr hc; Jean-Louis Teboul, MD, PhD

Crit Care Med 2006 Vol. 34, No. 5

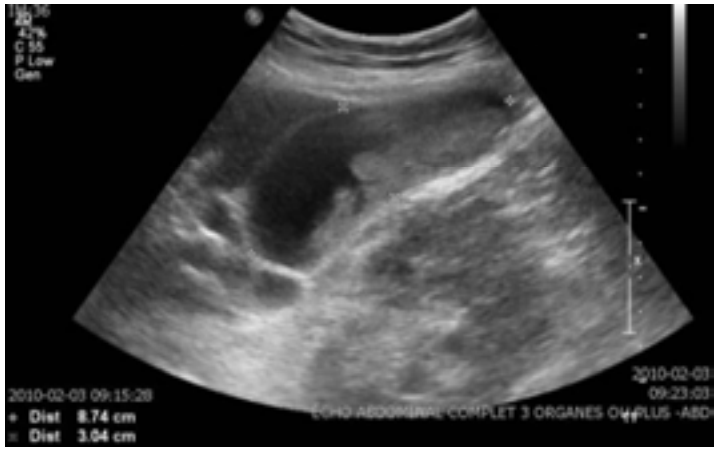
SOP ICM

Reduced Pms: why?

Hemothorax

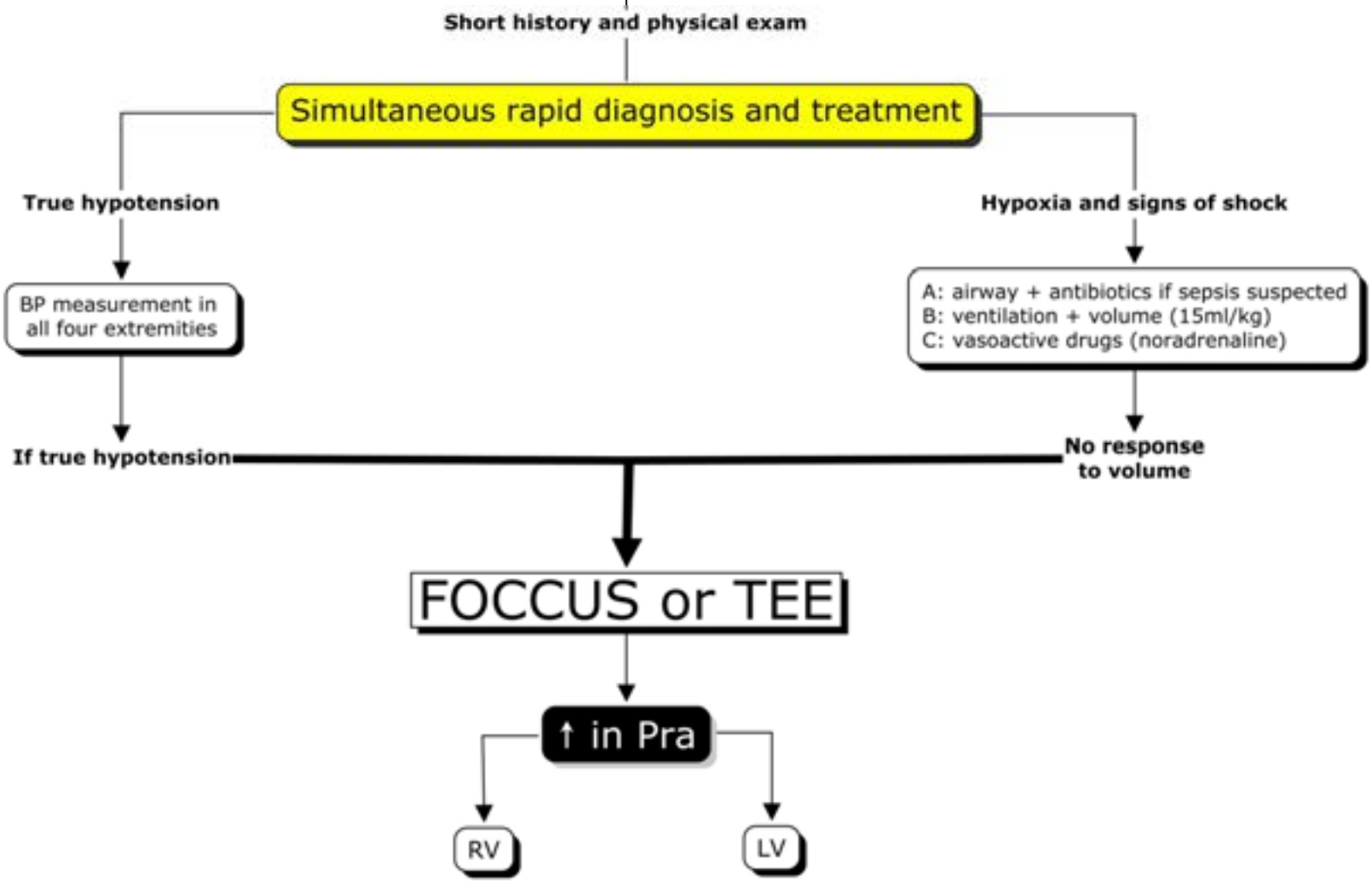
Pneumonia

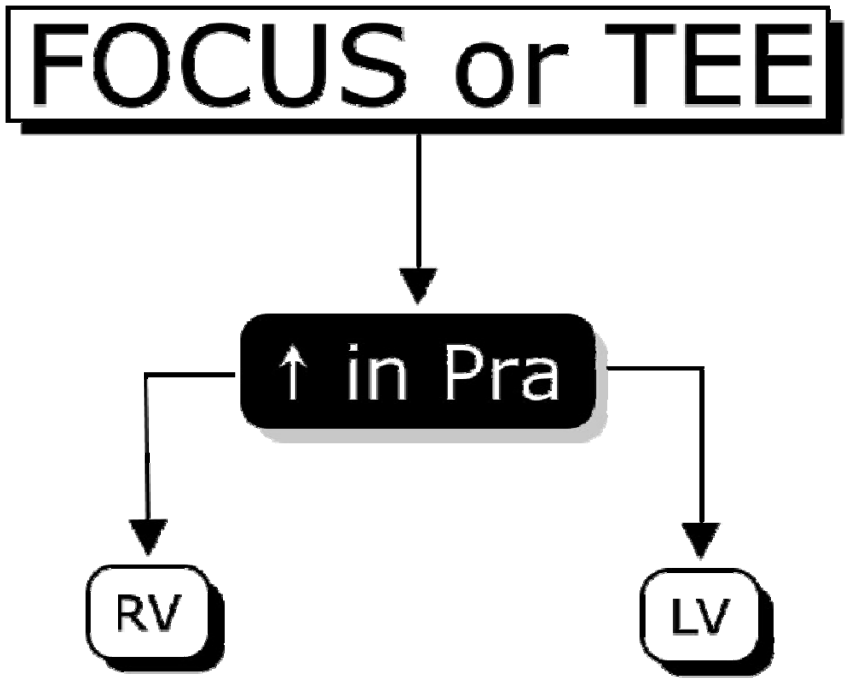
Peritonitis



Acute cholecystitis

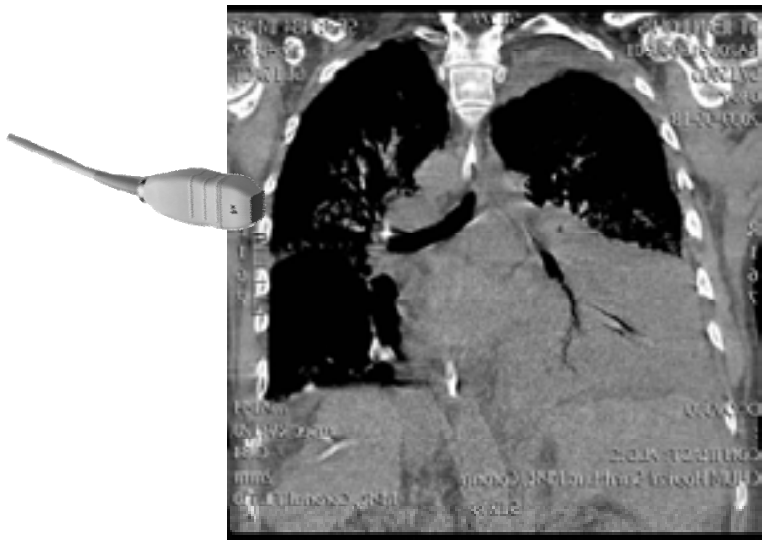
Choc cardiogénique

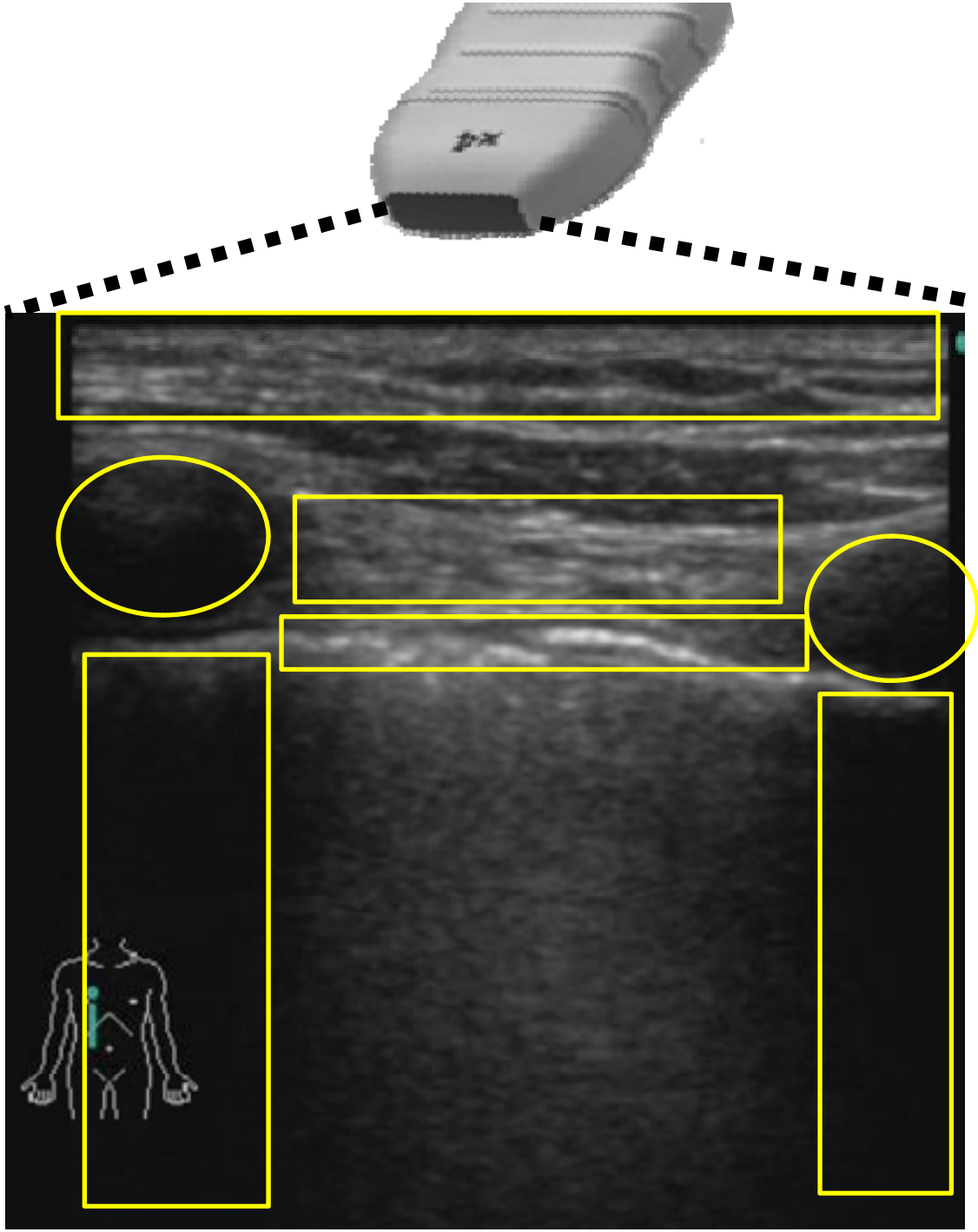


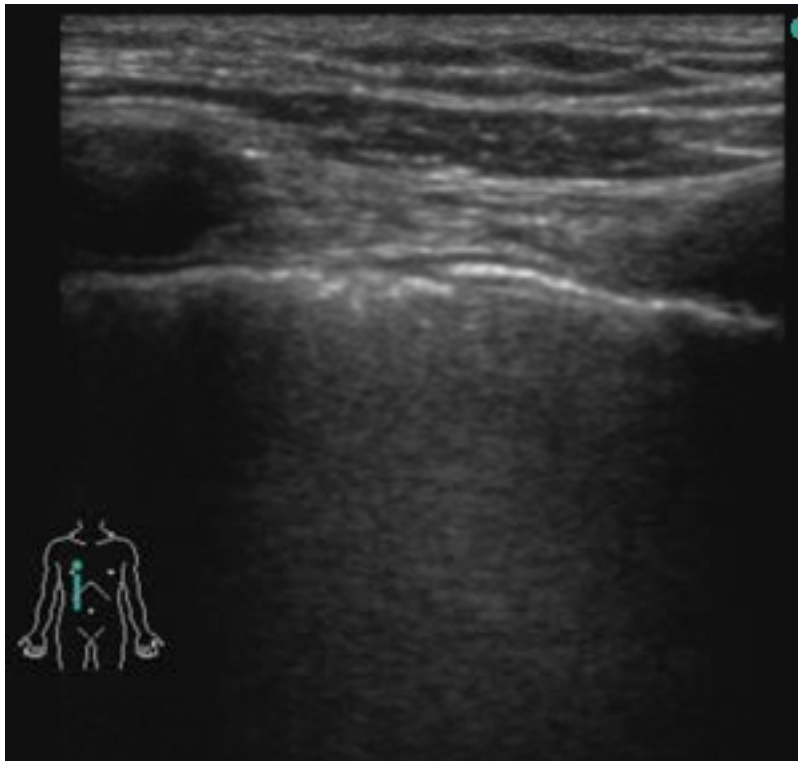


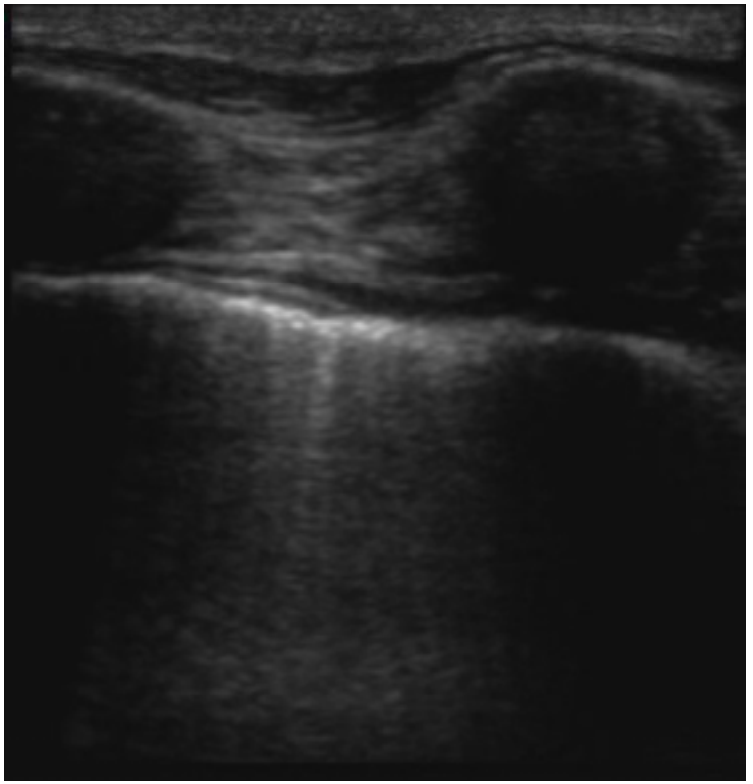
Hypoxia and hypercapnia
Systolic dysfunction
Diastolic dysfunction
Outflow tract obstruction
Pulmonary emboli

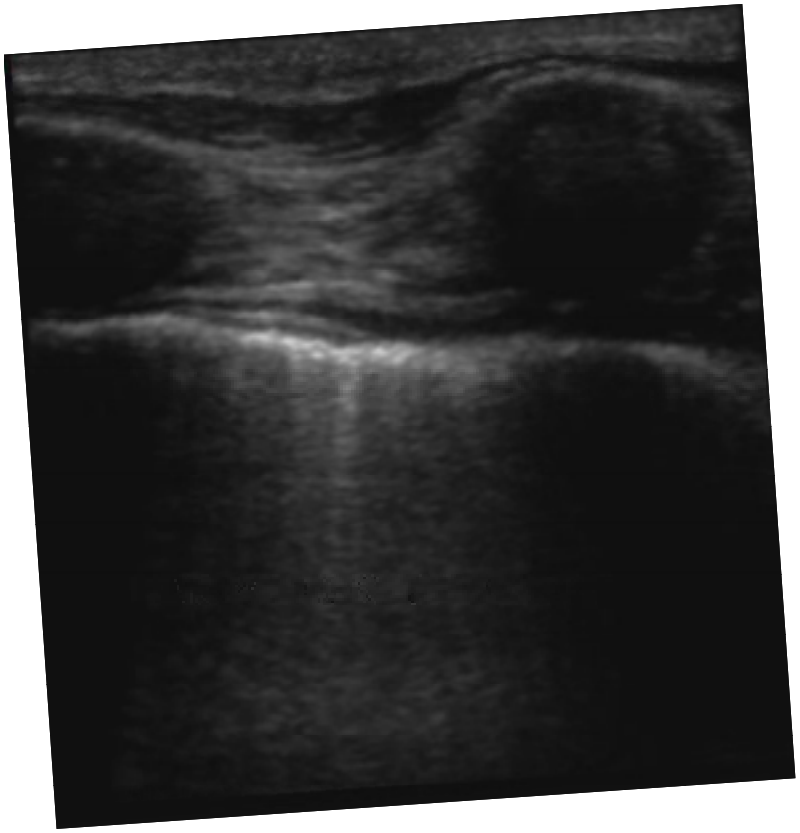
Others:
congenital, tumor, CMP, arythmias



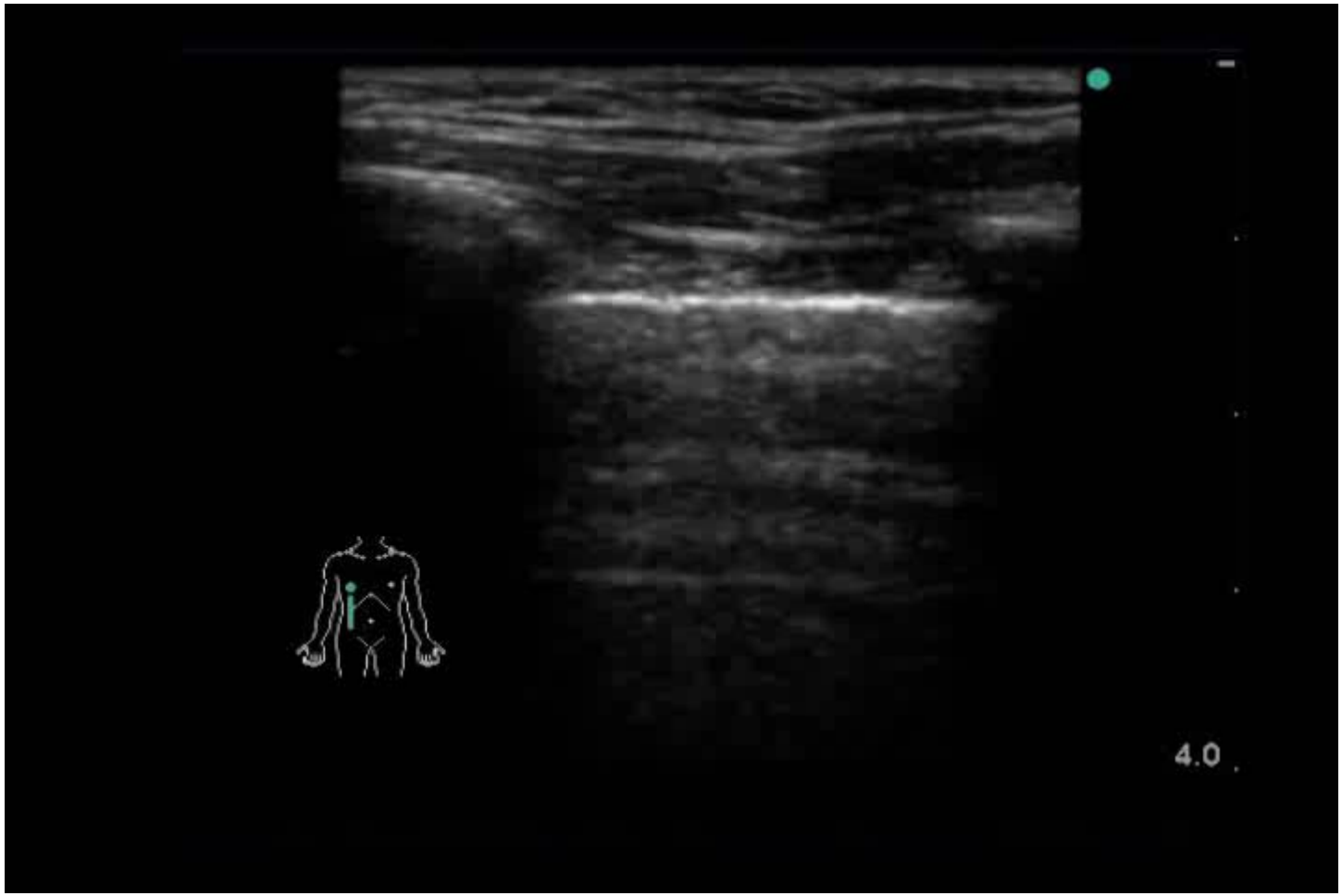






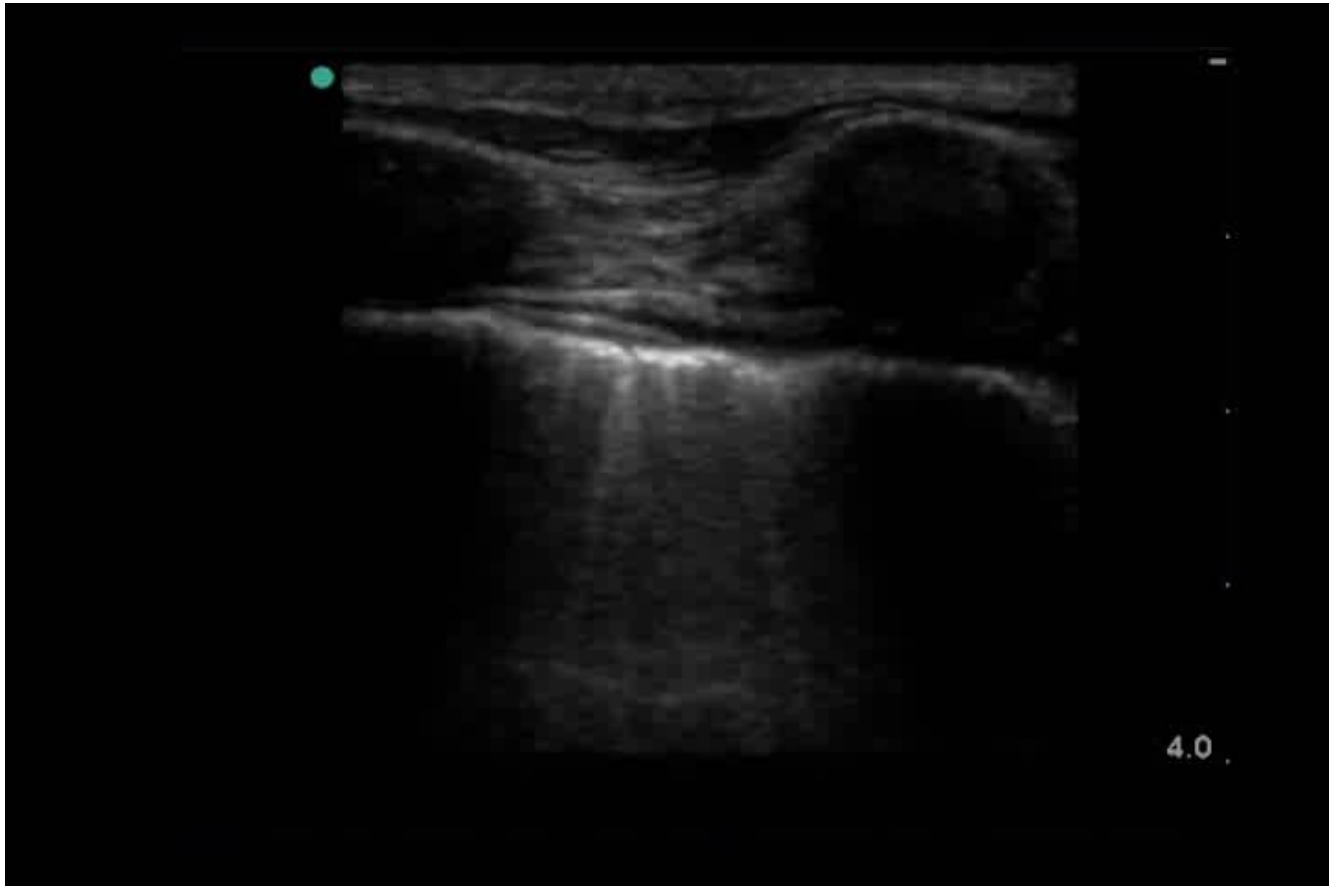


Sliding lung

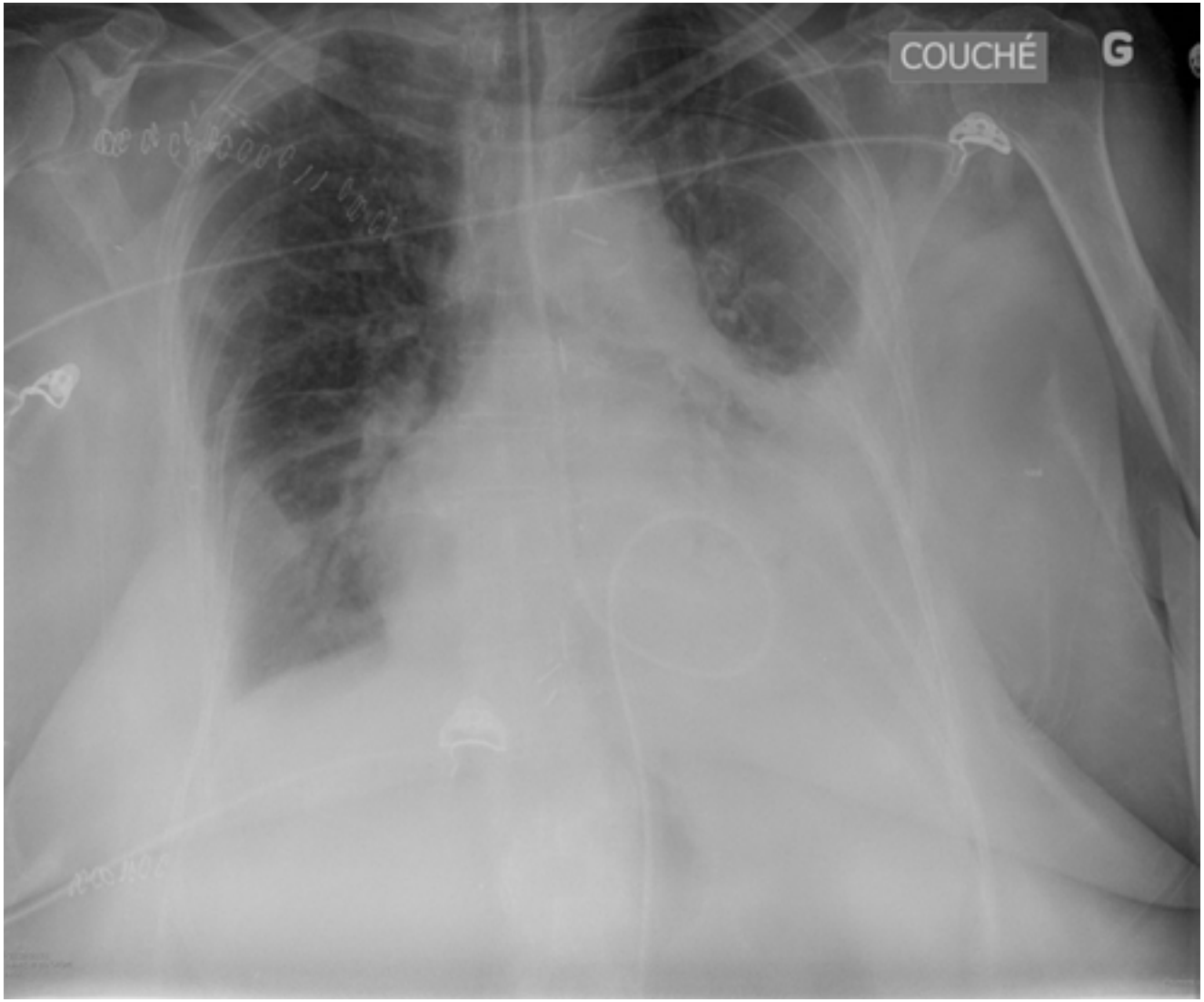


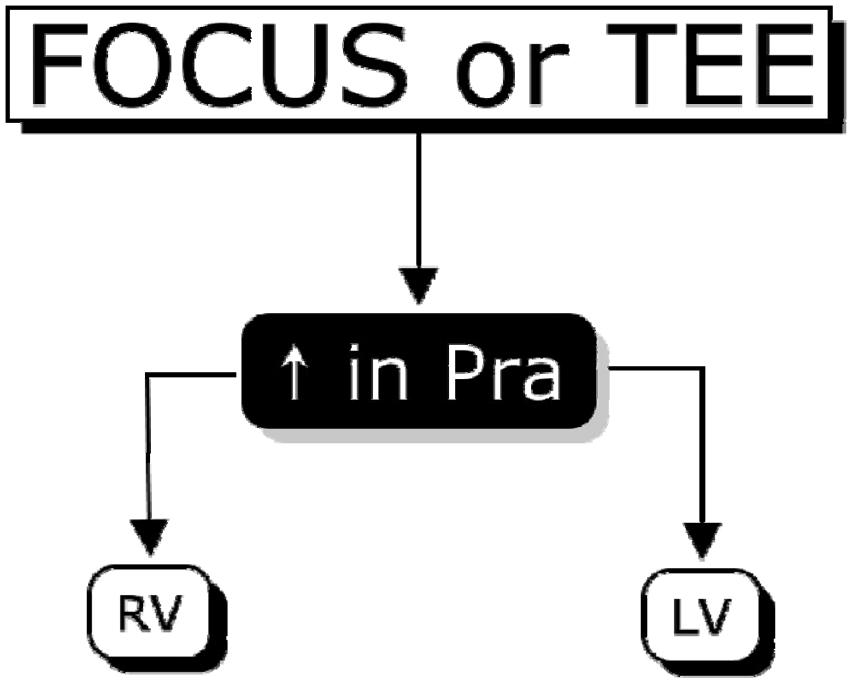
Sliding lung

B lines or comet tails



Other example

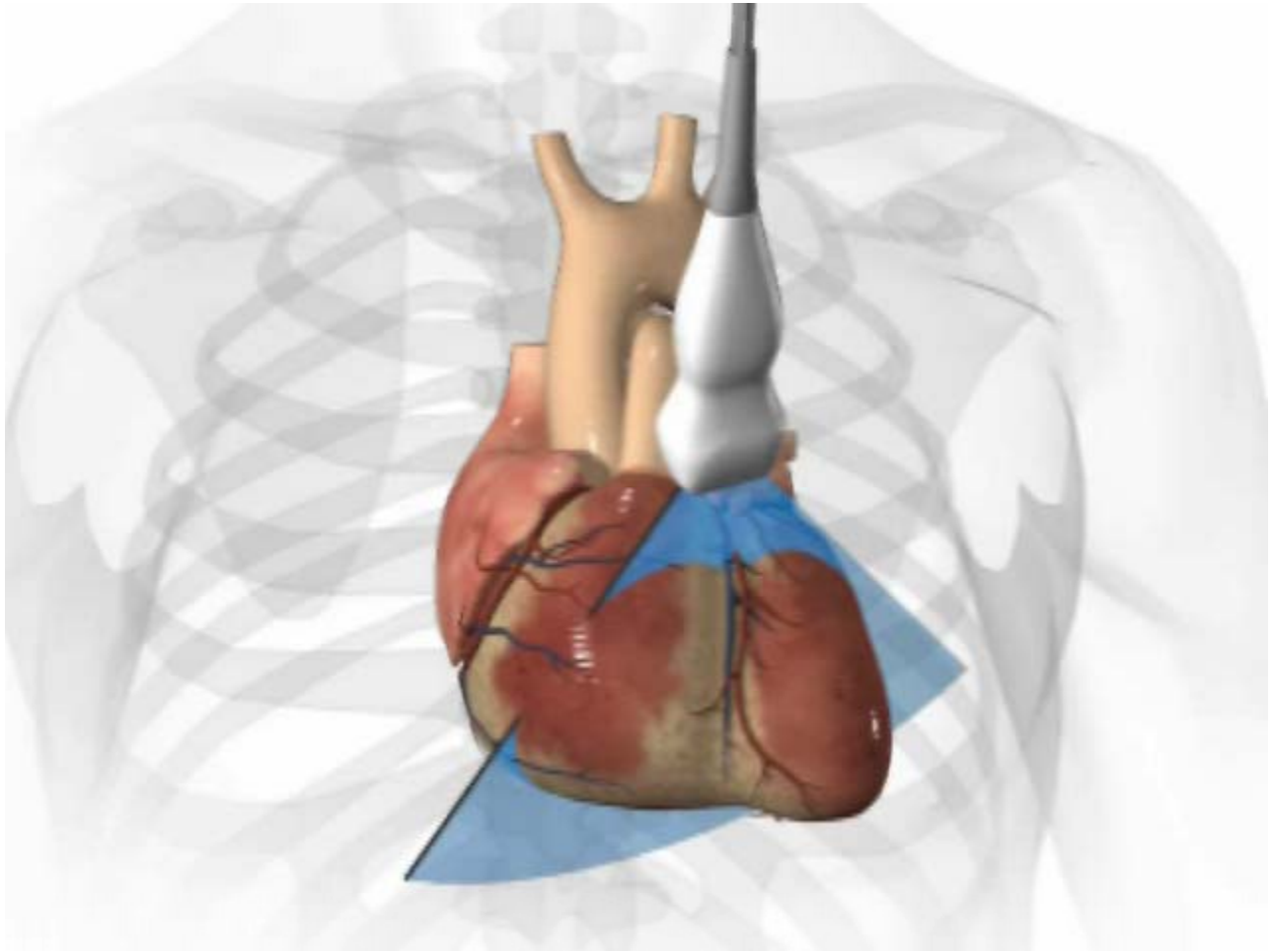

COUCHÉ
G



Hypoxia and hypercapnia
Systolic dysfunction
Diastolic dysfunction
Outflow tract obstruction
Pulmonary emboli

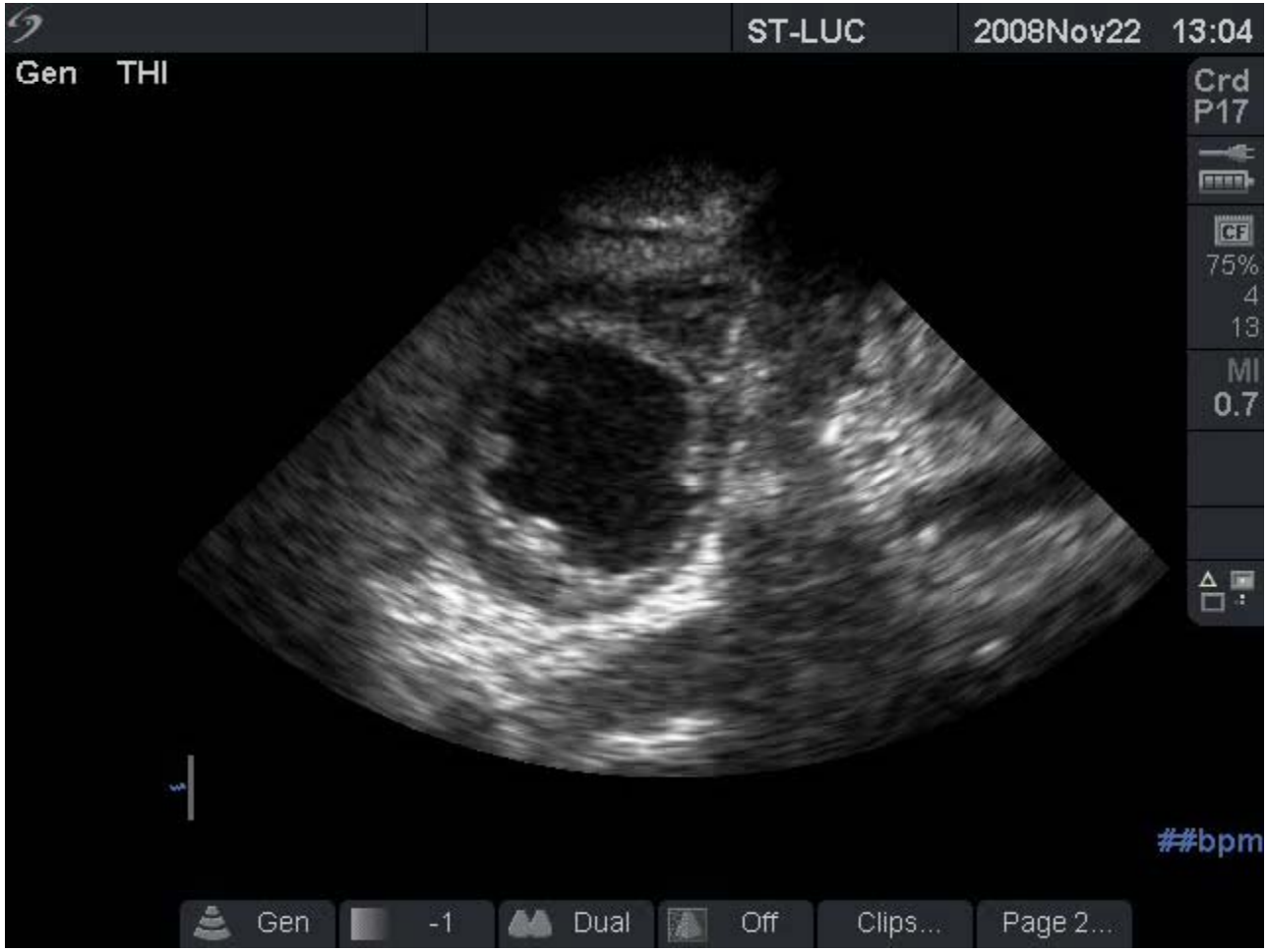
Others:
congenital, tumor, CMP, arythmias

Parasternal SAX




VIM

Unstable 32 yo ♂ after urgent laparotomy

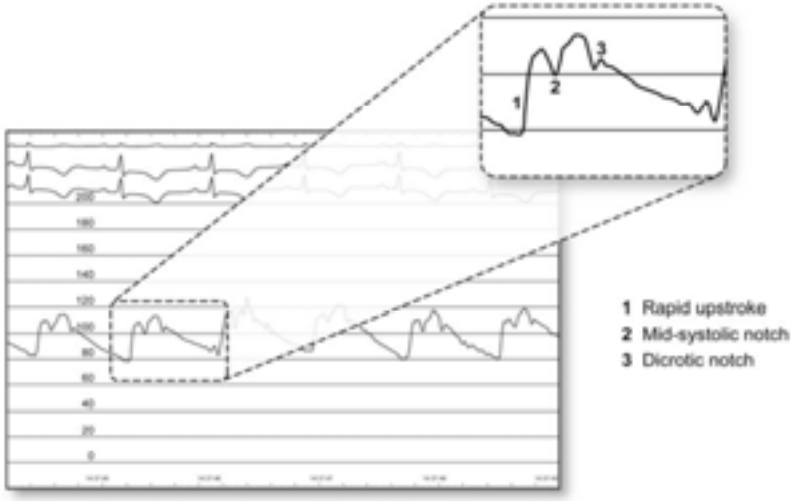


FOCUS or TEE

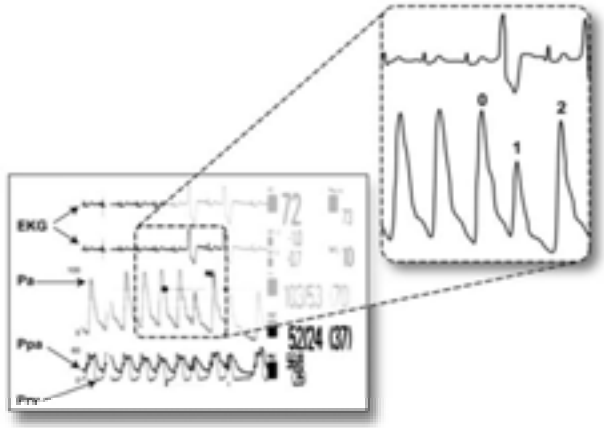
↑ in Pra

RV

LV



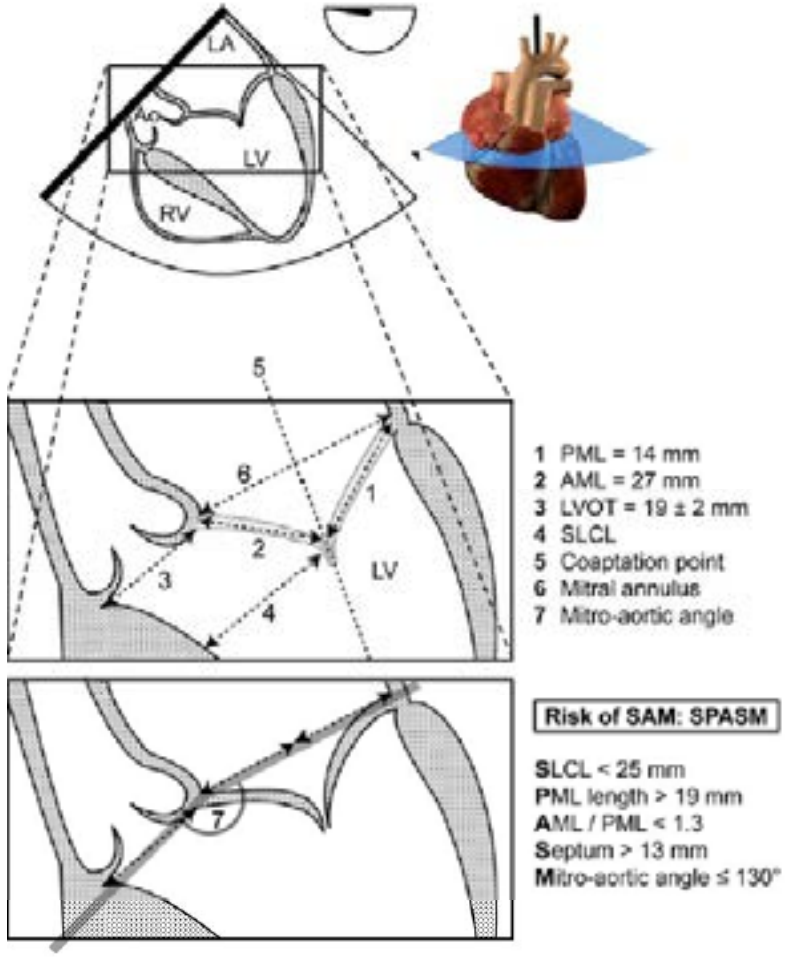
Hypoxia and hypercapnia
Systolic dysfunction
Diastolic dysfunction
Outflow tract obstruction
Pulmonary emboli



Others:
congenital, tumor, CMP, arythmias

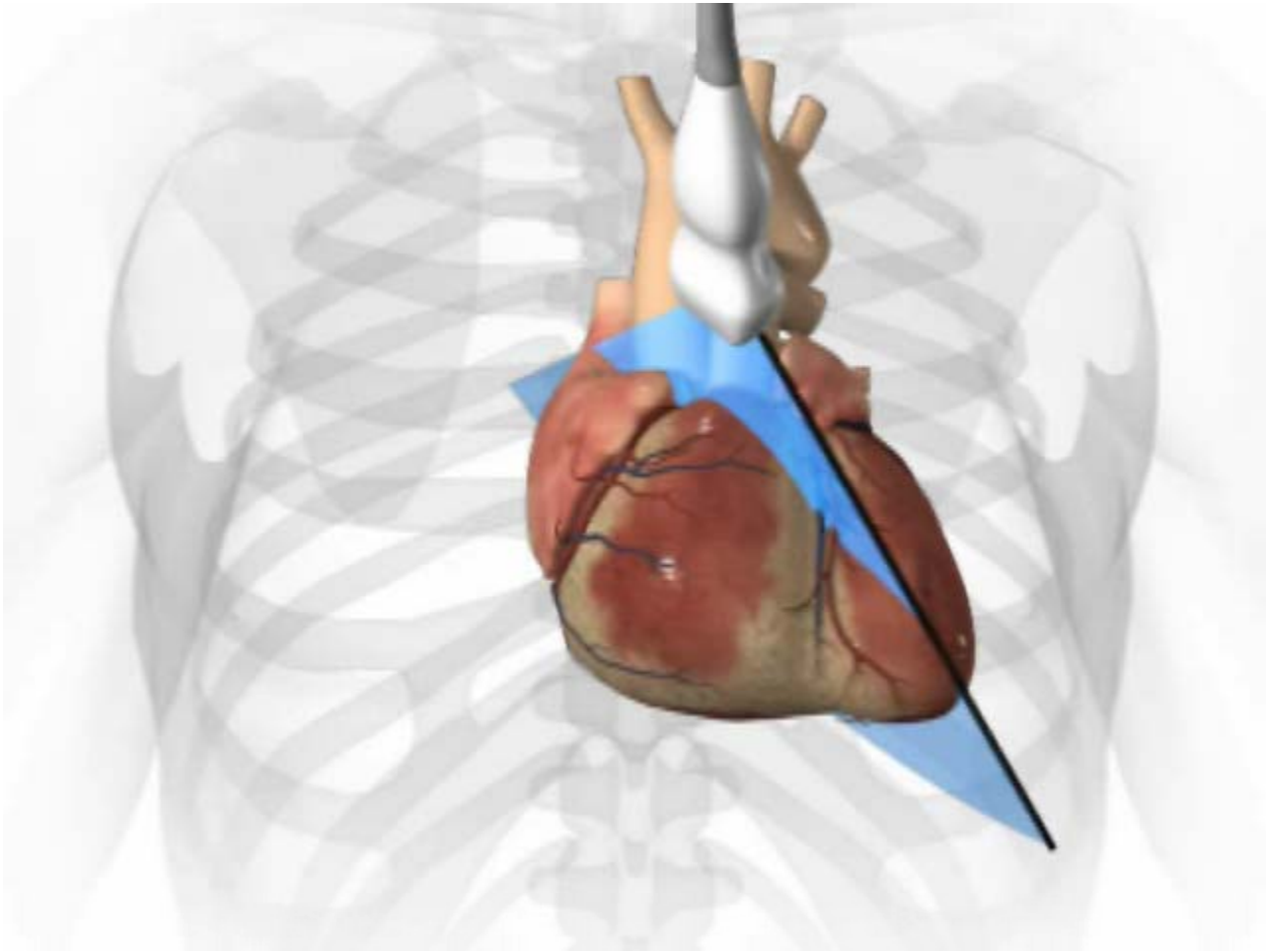
Always consider left ventricular outflow tract obstruction in hemodynamically unstable patients

Antoine G. Rochon, MD · Philippe L. L'Allier, MD · André Y. Denault, MD



Can J Anesth/J Can Anesth (2009) 56:962–968

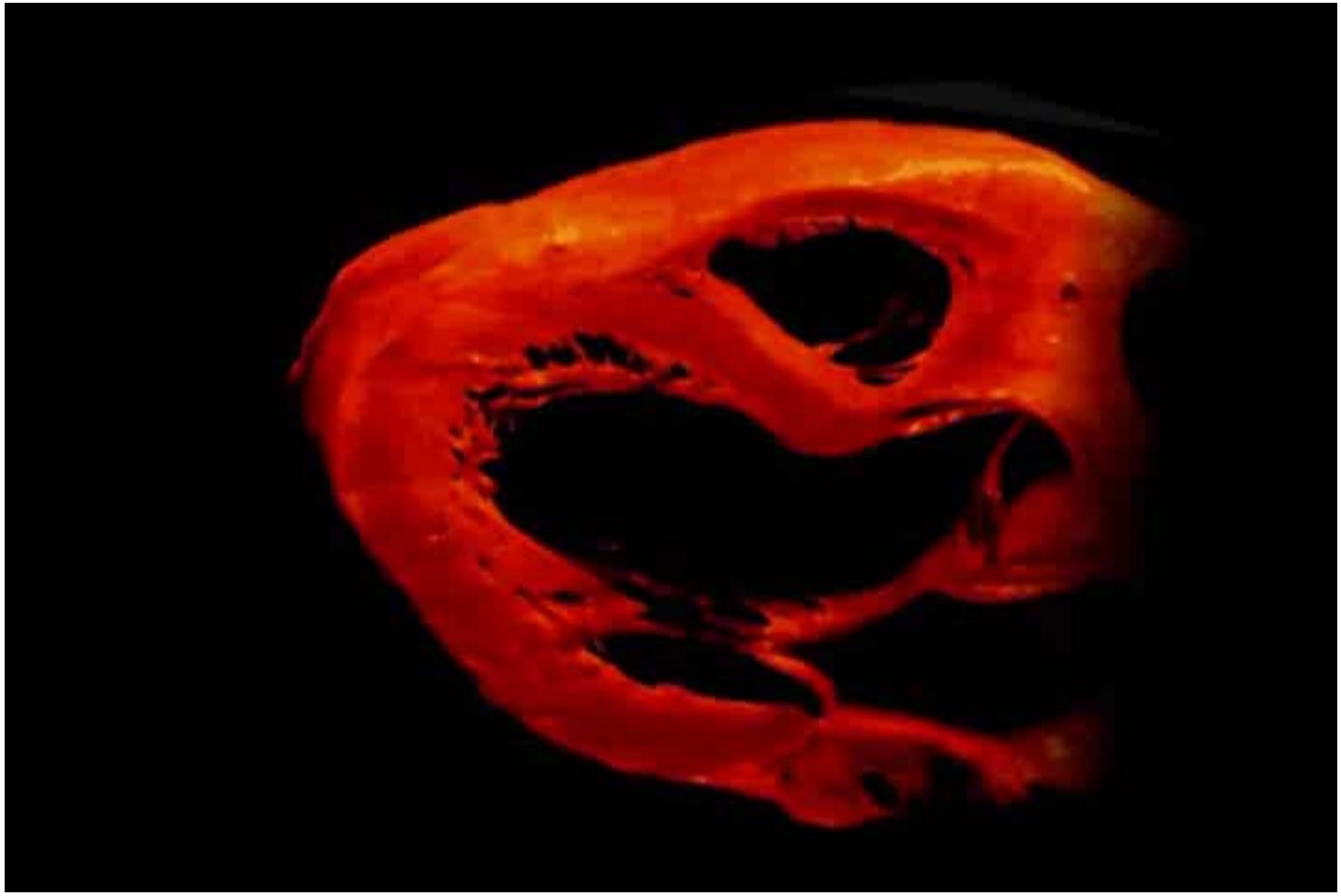
Parasternal LAX view



Para-sternal LAX view

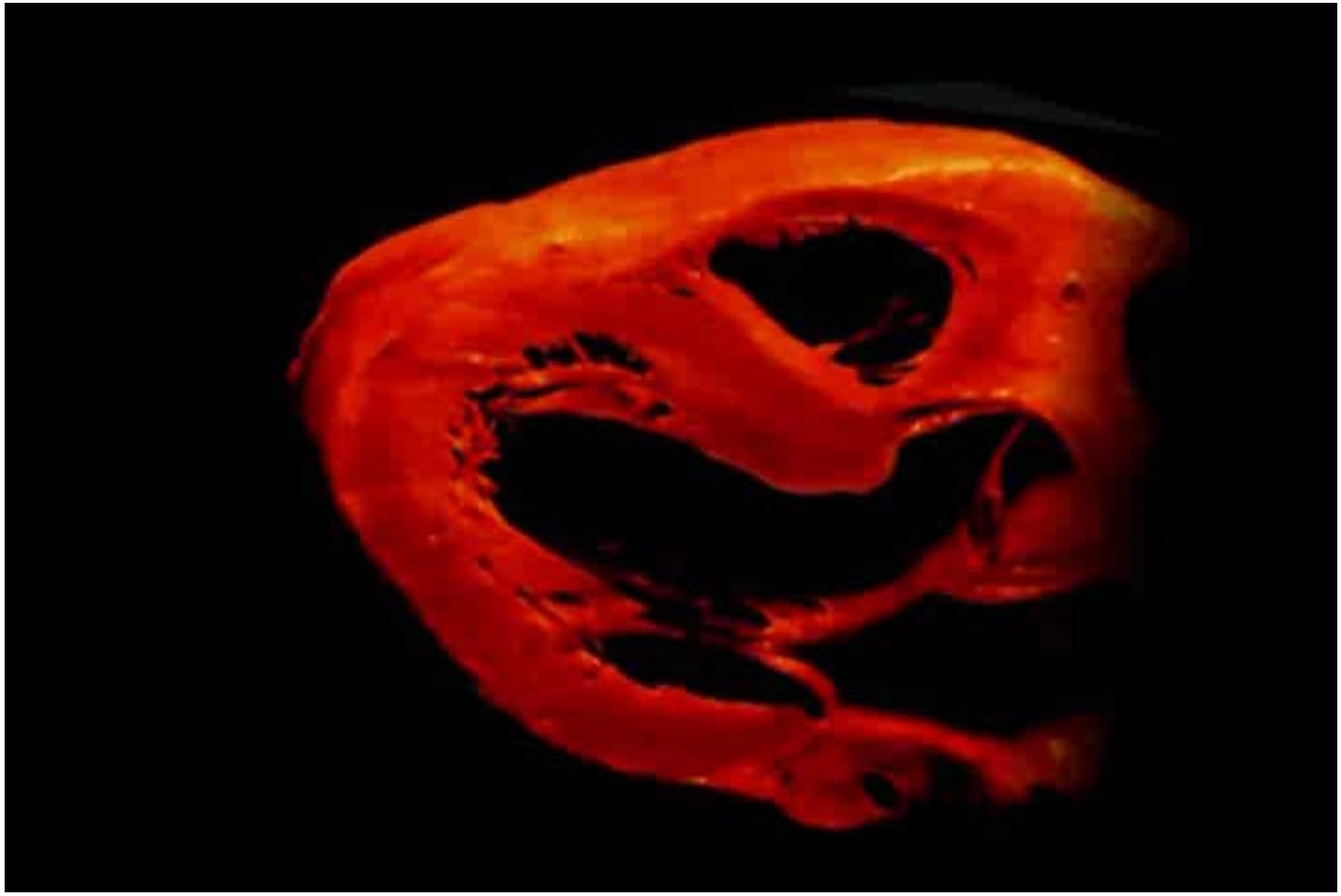

V
5
10
97
HR

LV outflow tract obstruction



Curtesy of Gaudani

LV outflow tract obstruction

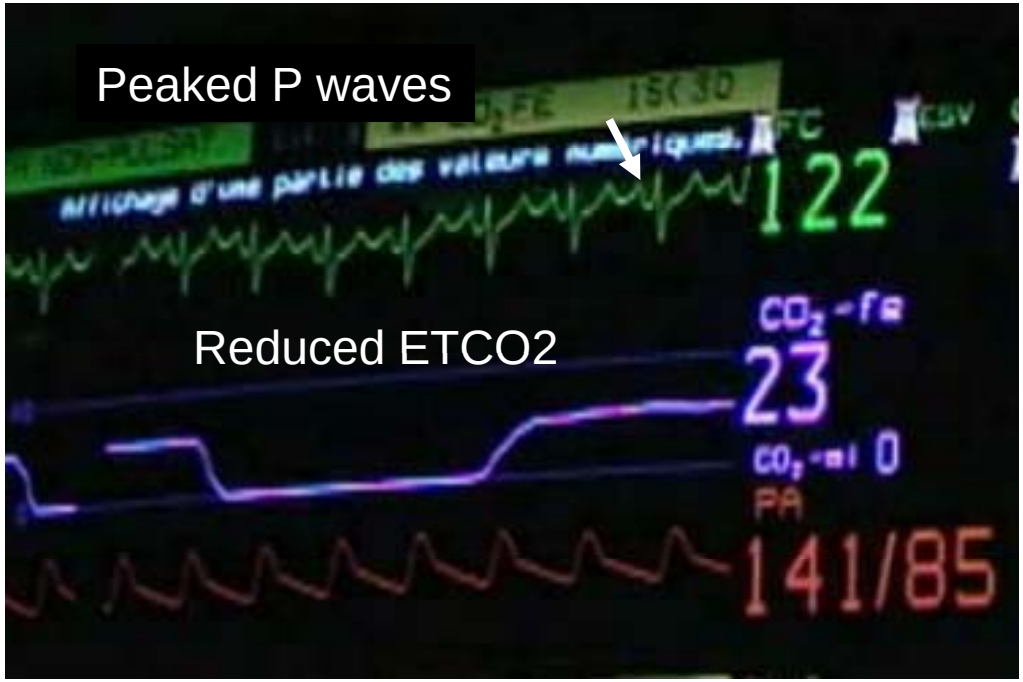


Curtesy of Gaudani

FOCUS or TEE

↑ in Pra

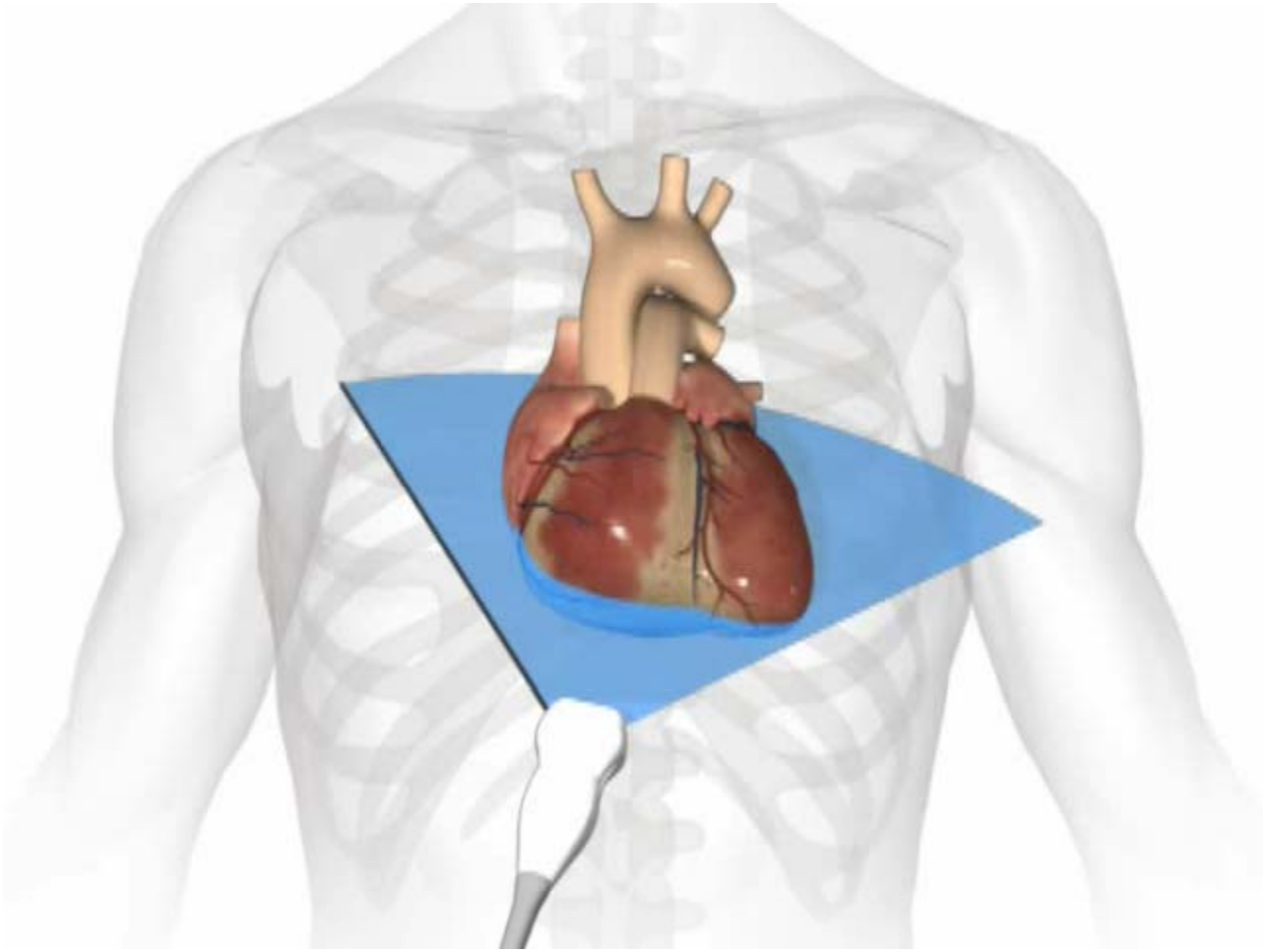
- RV
- LV



Hypoxia and hypercapnia
Systolic dysfunction
Diastolic dysfunction
Outflow tract obstruction
Pulmonary emboli

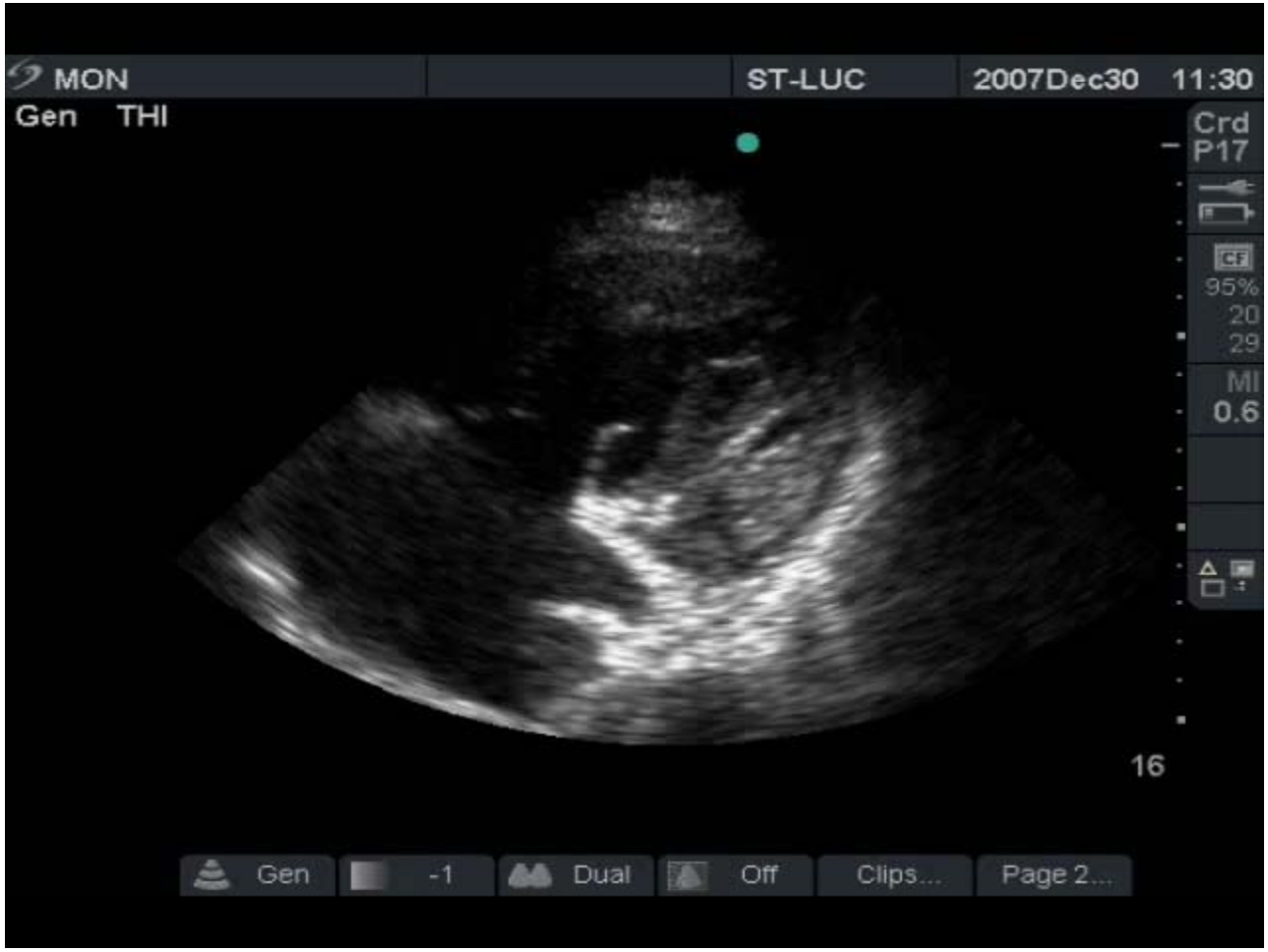
Others:
congenital, tumor, CMP, arythmias

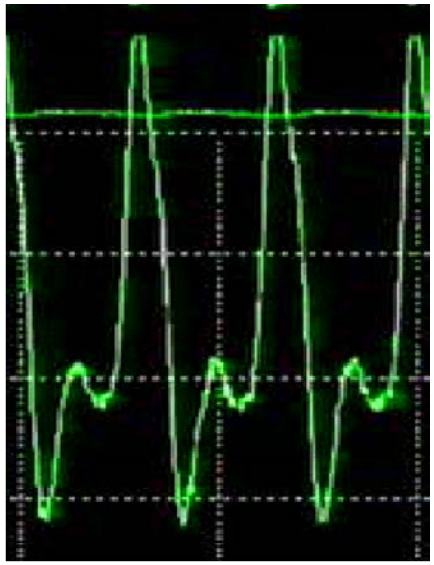
Sub-costal view 0°



Sub-costal view 0°

RV systolic dysfunction





FOCUS or TEE

↑ in Pra

RV

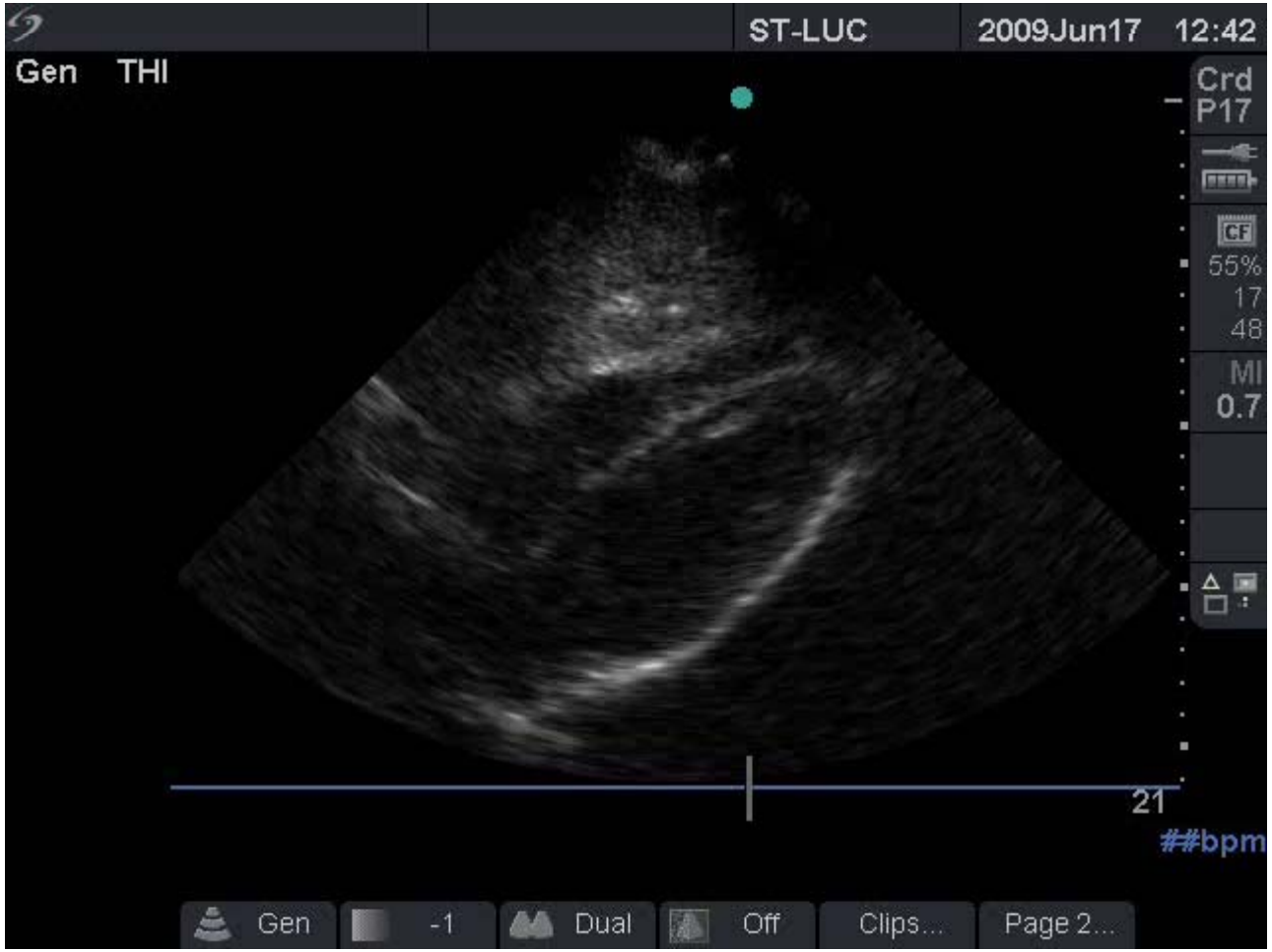
LV

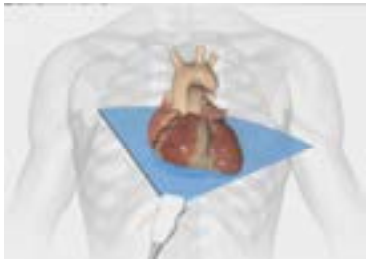
Hypoxia and hypercapnia
Systolic dysfunction
Diastolic dysfunction
Outflow tract obstruction
Pulmonary emboli

Others:
congenital, tumor, CMP, arythmias

25 yo ♂ post-op laparotomy for abdominal perforation

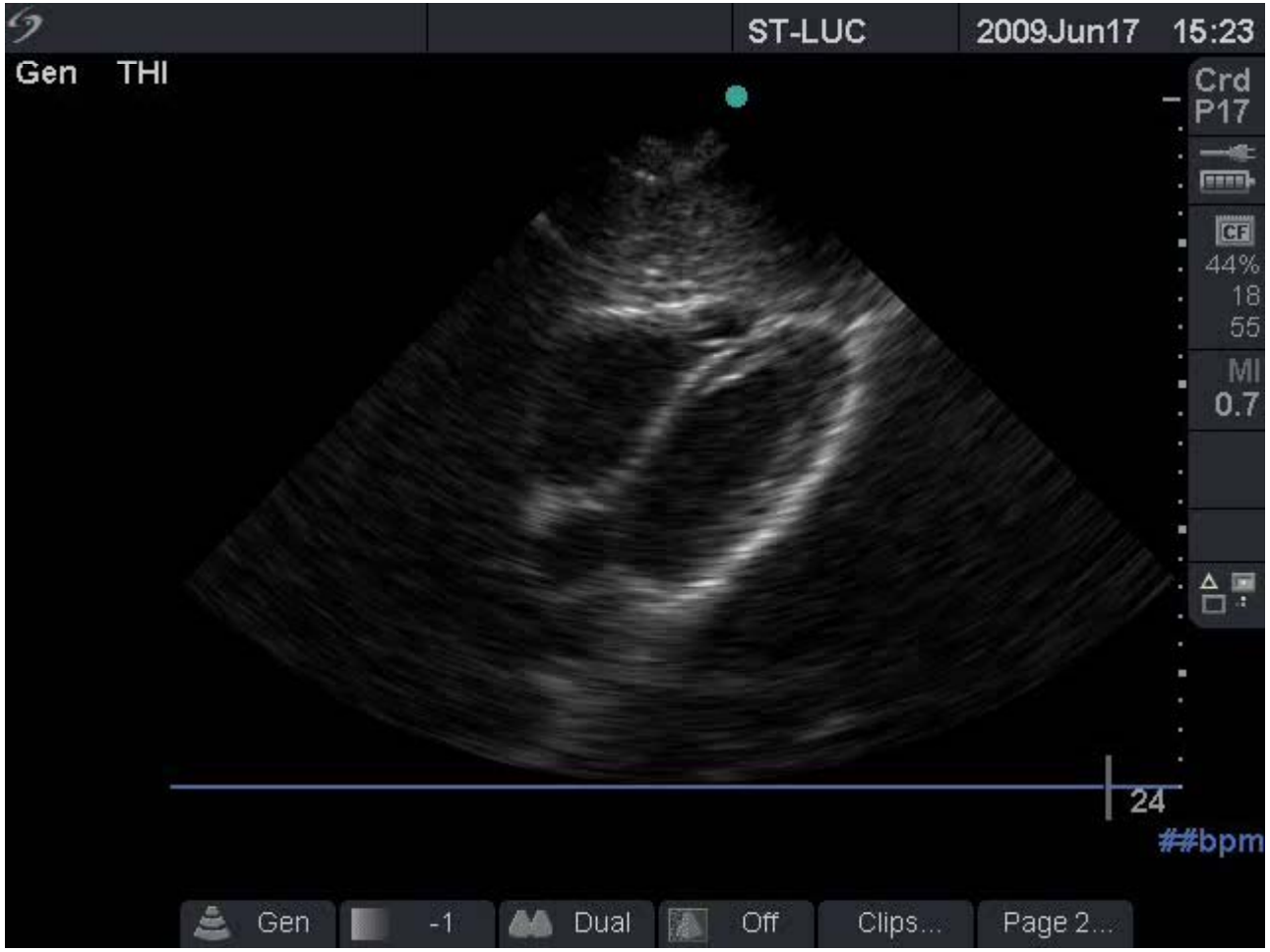
Noradrenalin 0.17 ug/kg/m (50ml/h)

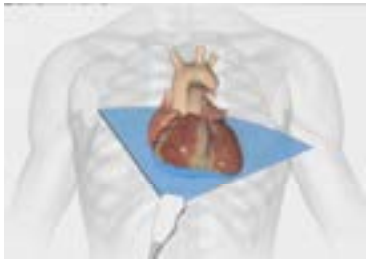


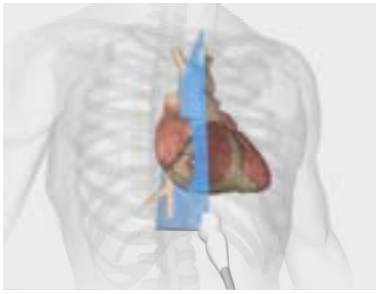


25 yo ♂ post-op laparotomy for abdominal perforation

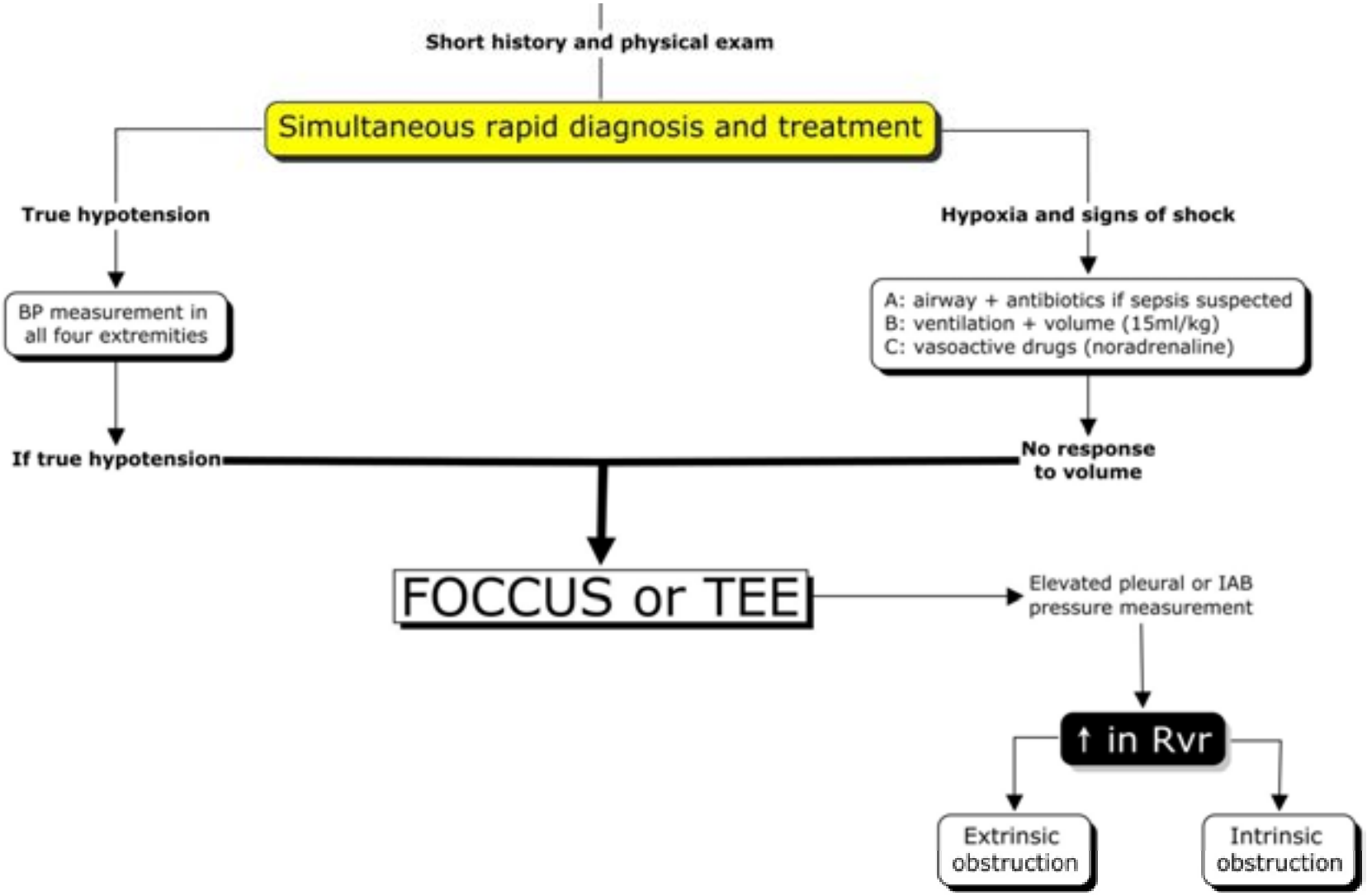
Noradrenalin stopped after 2h of dobutamine

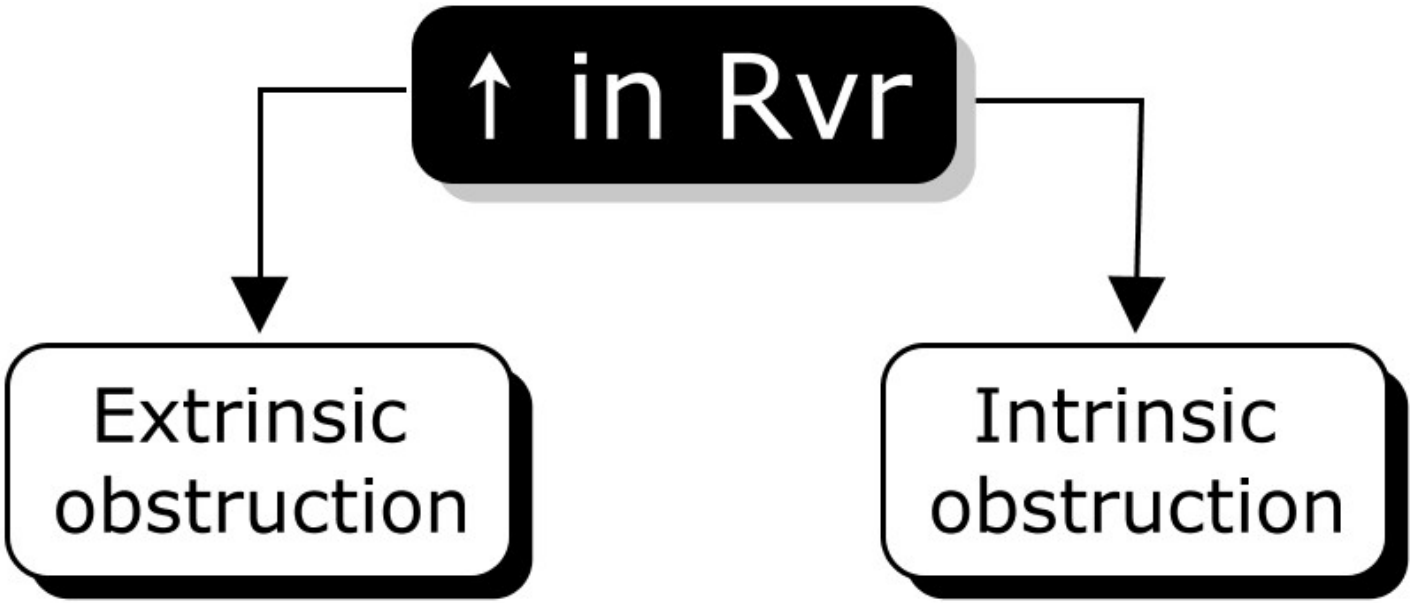






Choc cardiogénique

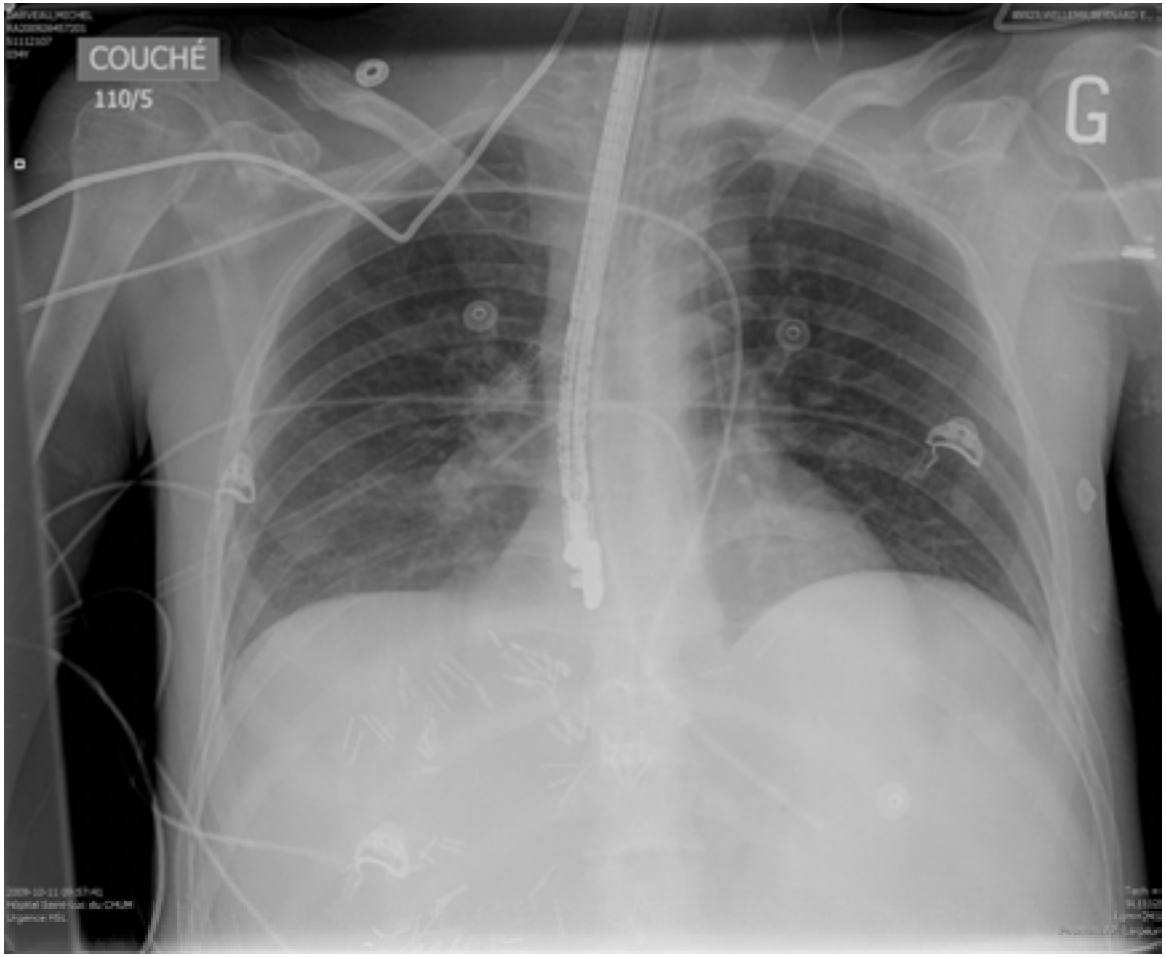




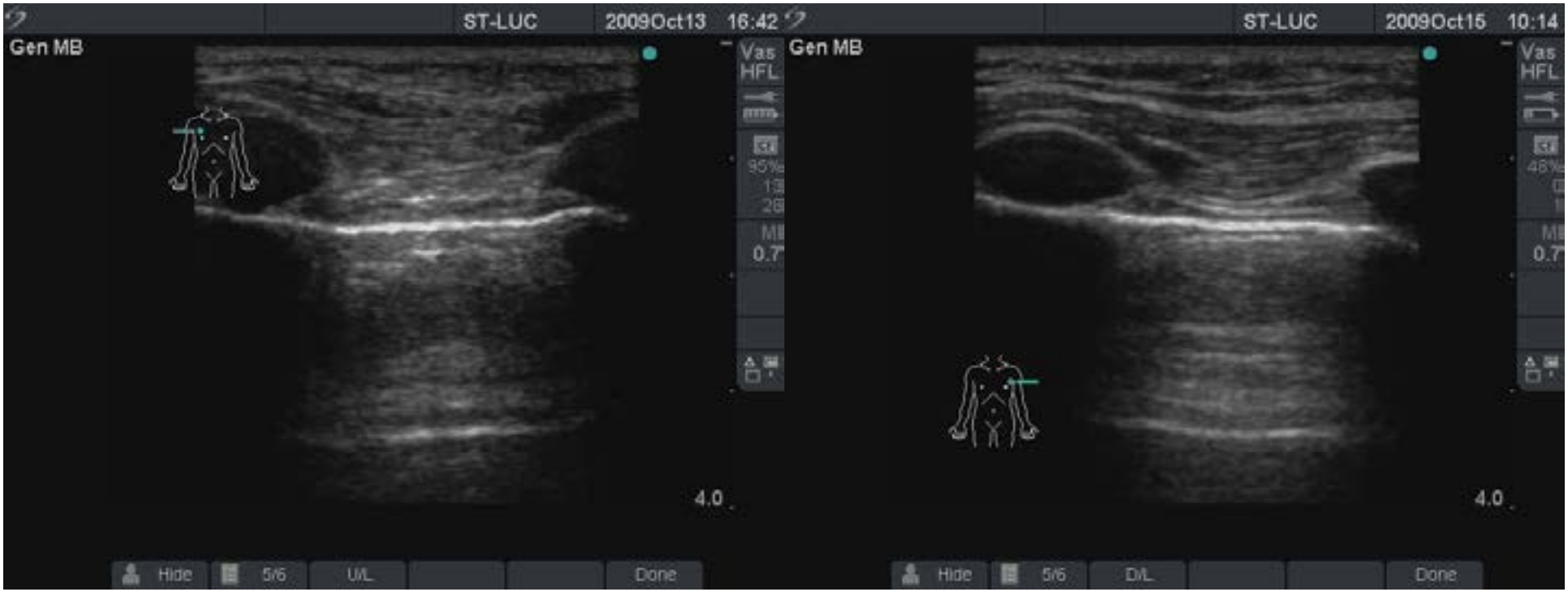
Pericardial tamponade
Pleural compression: air or fluid
Mediastinal compression
Abdominal compression

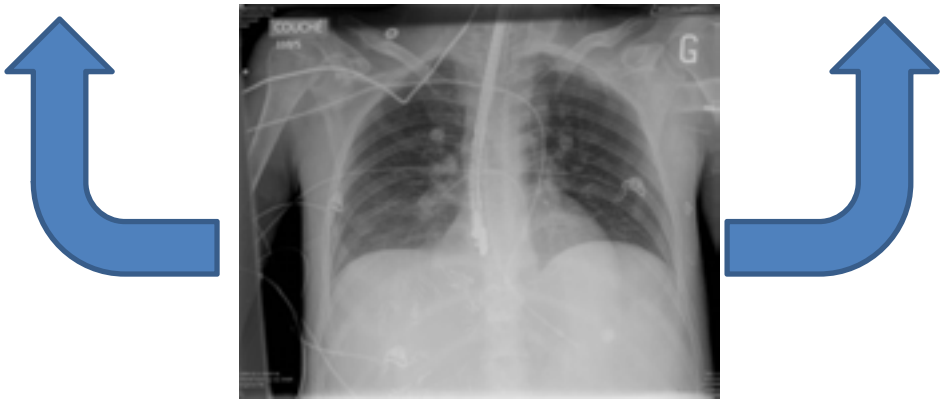

83 1.6/3.2
28 JAN 04
11:14:43
2/2/E/H5
I.C.M.
ADULTE
ST-LAURENT
GAIN 72
COMP 55
866PM
22CM
52HZ
P
A
1.6 3.2

42 yo ♂ after liver transplantation: desaturation

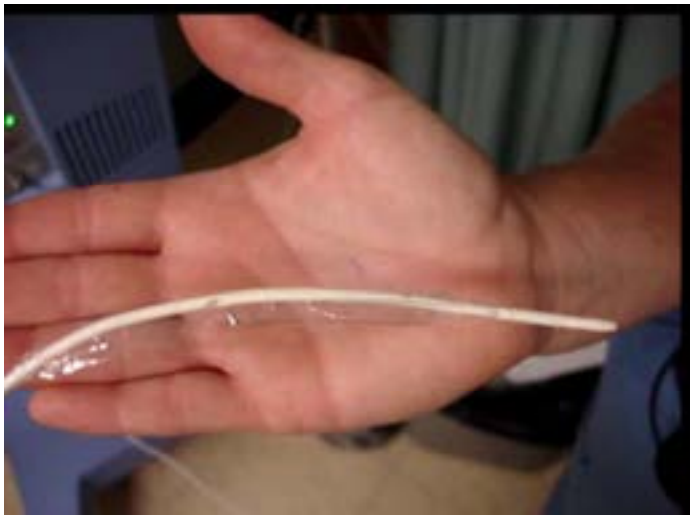


42 yo ♂ after liver transplantation: desaturation





Monitoring of abdominal and transmural pressure

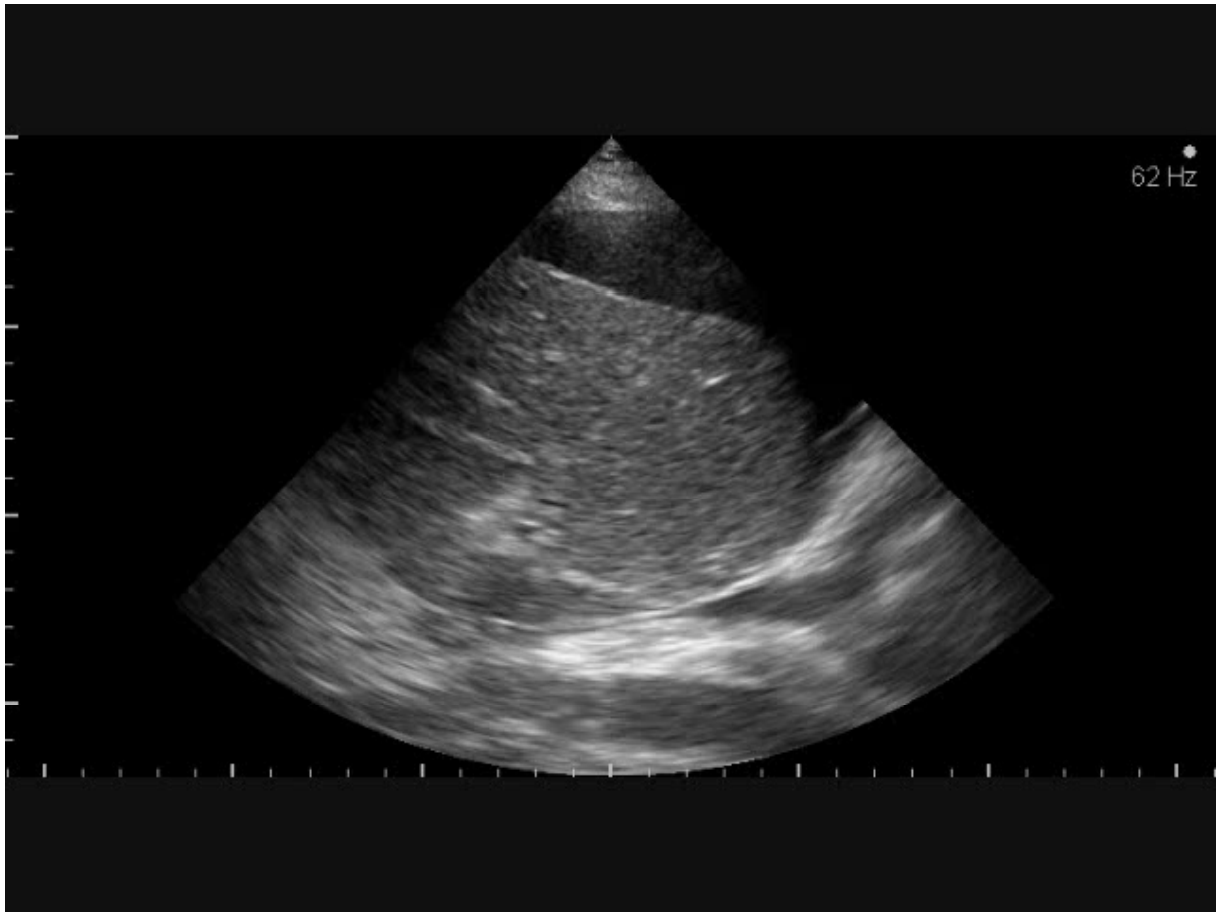


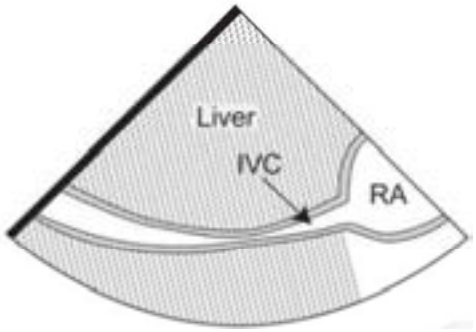
World Society of the Abdominal Compartment Syndrome

WORLD SOCIETY OF THE ABDOMINAL COMPARTMENT SYNDROME

Home | Education | Join WSACS | Discussion | Research | For Patients | Me

Mixed mechanisms

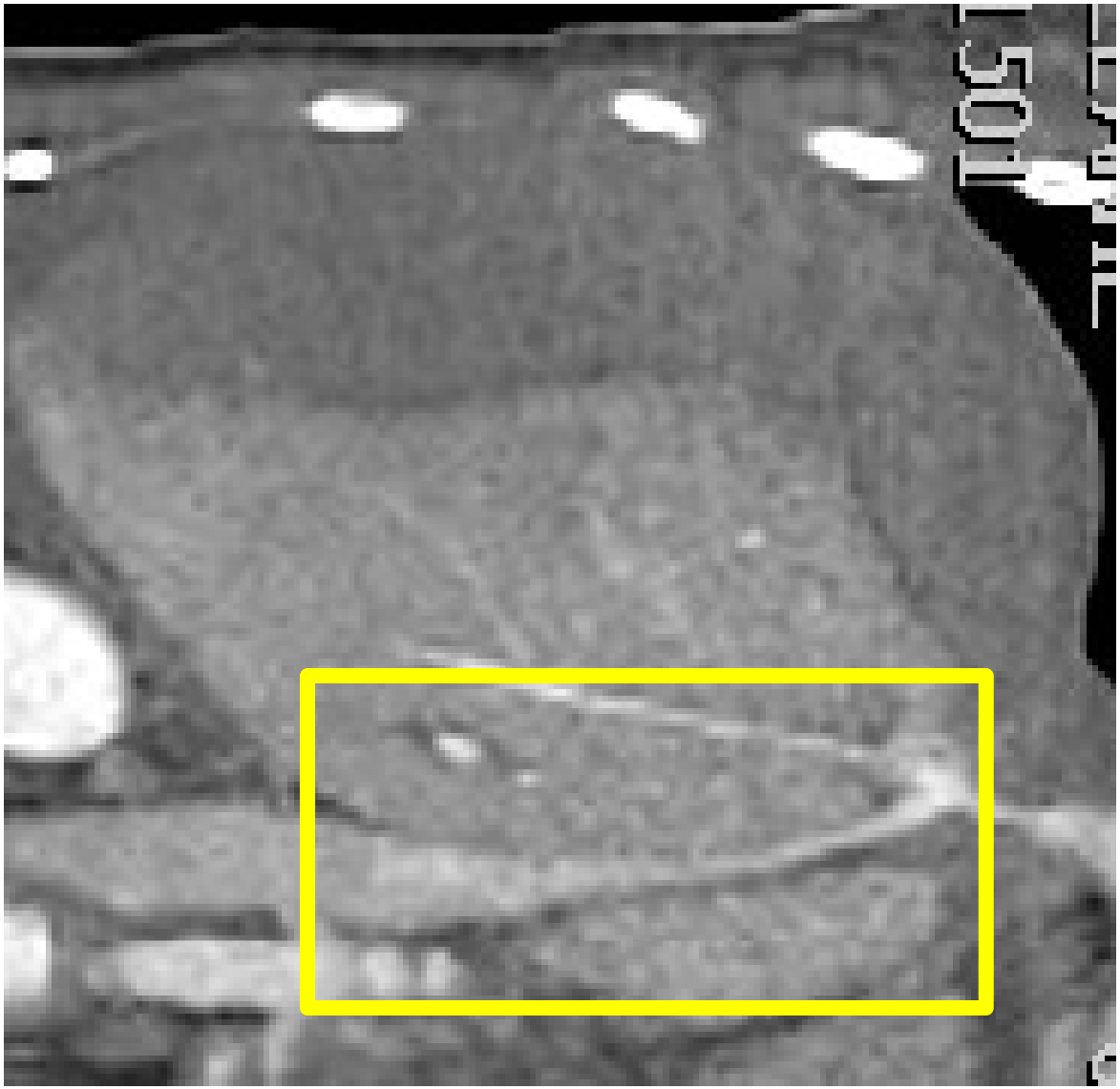




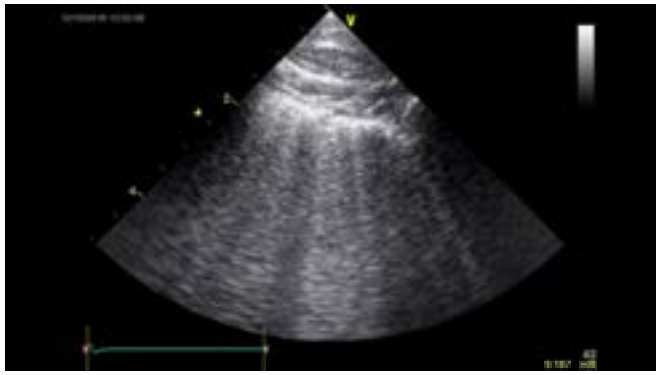
Courtoisie Dr Philippe Rola

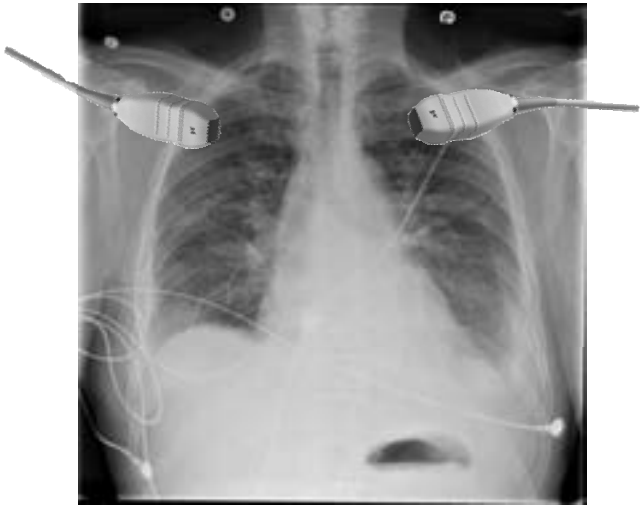
20 yo ♂ HELLP syndrome

20 yo woman HELLP syndrome



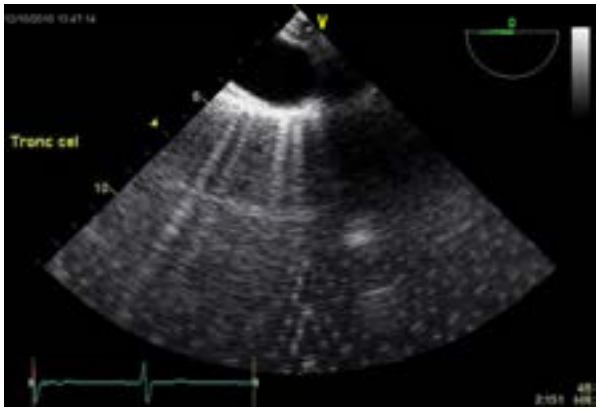
86 yo ♂ hypotension and desaturation

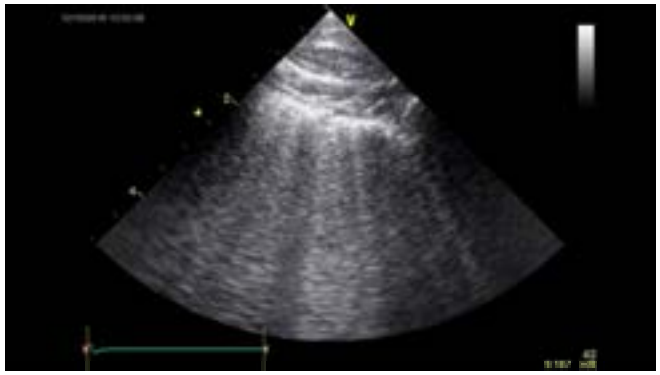




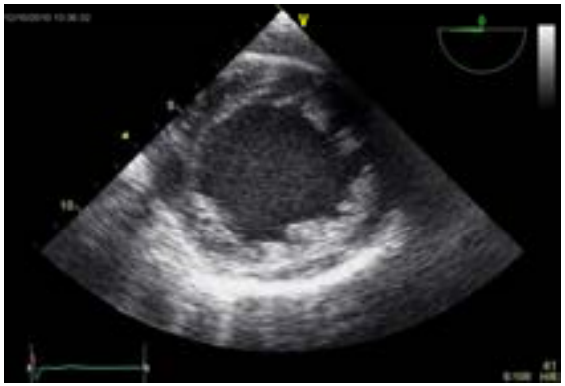
A

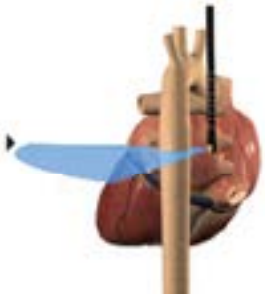
B

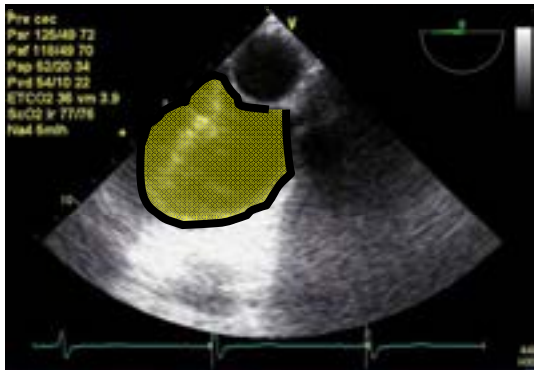





1600
1400
1200
1000
800
600
400
200







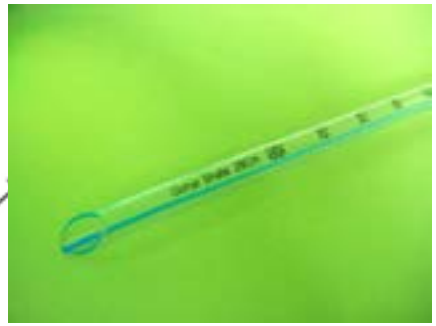
In summary


107
-0.2
0.1
104/37
44/29
57/16
34
32

=


PEDIATRIC
25.09.05
L 36
SYSTEM SIGNAL OK
R 43
LEFT
RIGHT
MAIN MENU

Intrinsic



↑Rrv → **Obstructive shock**

Obstructive

Shock state

Hypotension
Oliguria
Cold extremities
Neurological alteration
Acidosis

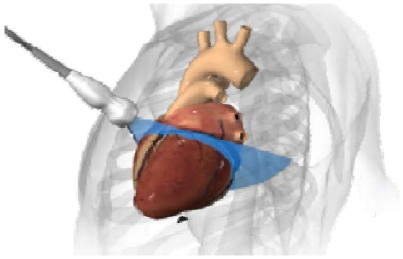
Hypovolemic shock → Non blood losses

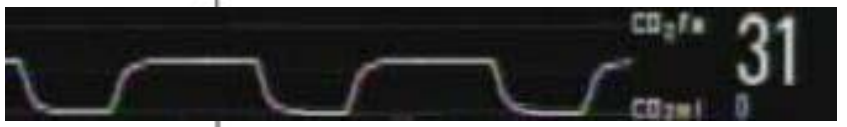
Cardiogenic shock → Diastolic

↓Pms → **Distributive shock** → Non-septic

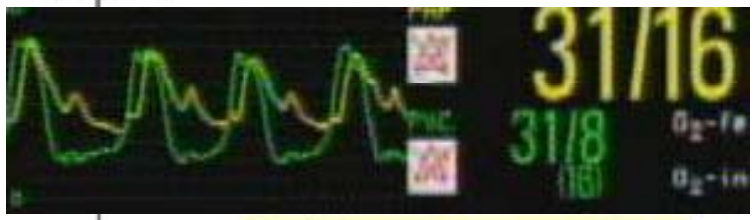
↑Pra → **Cardiogenic shock**

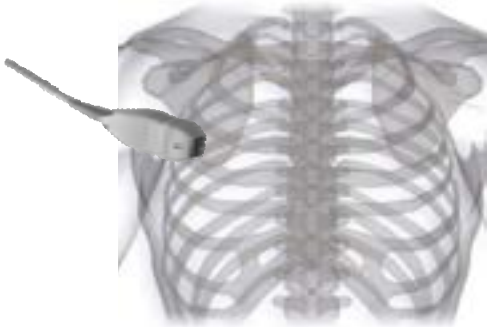
Choc cardiogénique





Depends on






Merci de votre attention!

Denis Babin M.Sc. Env.
Inhalothérapeute

Remerciements