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université
de BORDEAUX

[illegible]Perren A et al. *Intensive Care Med* 2013;39:1885-95

Teboul et al. *Critical Care* 2010, **14**:211
<http://ccforum.com/14/2/211>



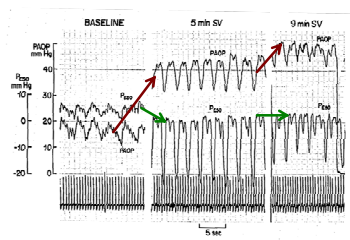
Weaning failure of cardiac origin: recent advances

Jean-Louis Teboul*, Xavier Monnet, and Christian Richard

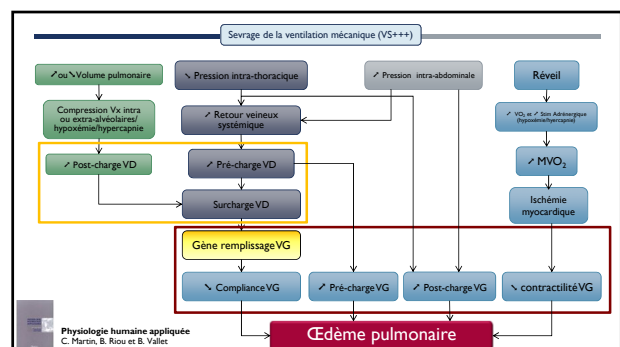
15 pts BPCO porteurs pathologie cardiaque

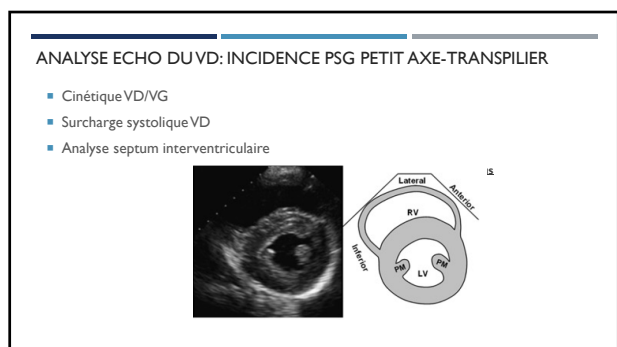
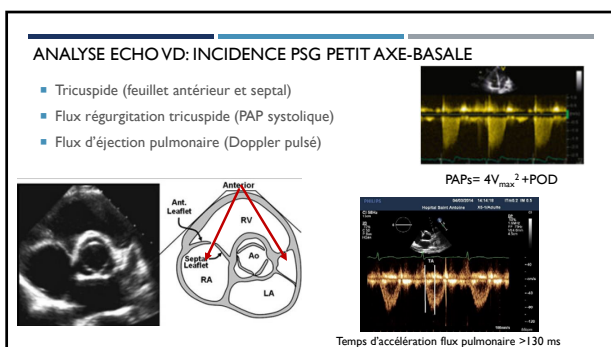
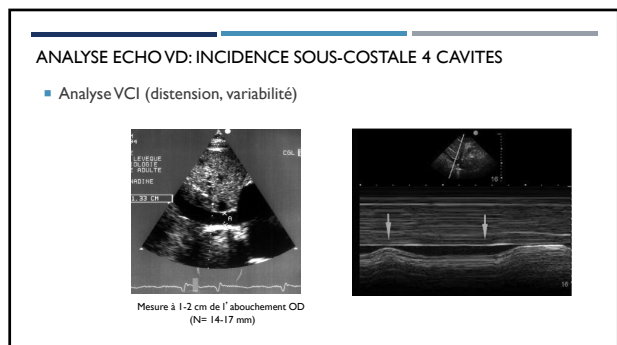
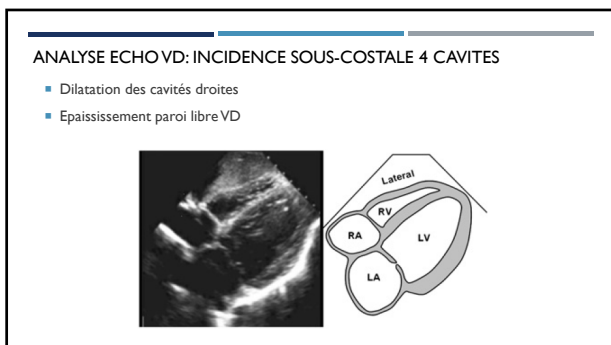
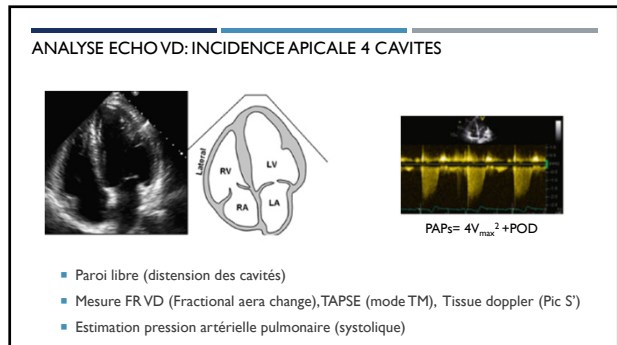
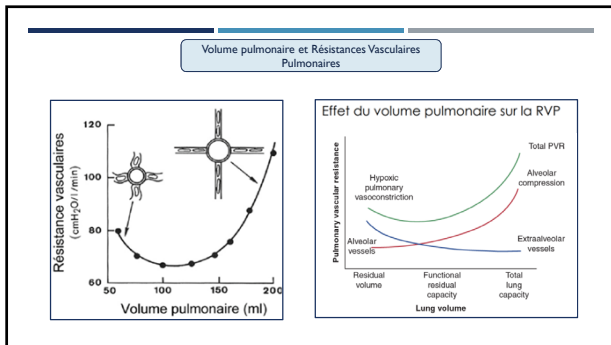
- Passage en ventilation spontanée (10 min)
- Pression oesophagienne ↘ de +5 à -2 mmHg
- DC ↗ de 3,2 à 4,3 L.min⁻¹
- FC ↗ de 77 à 90 bpm
- PAPO ↗ 8 à 20 mmHg

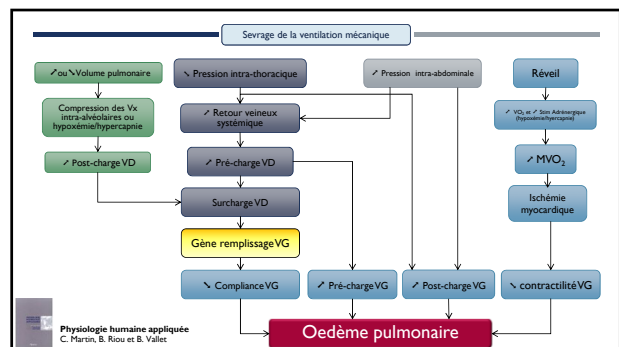
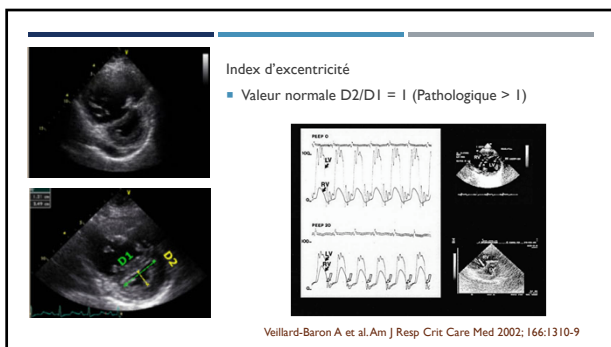
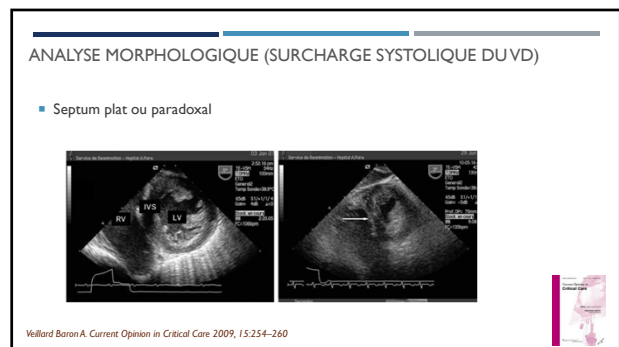
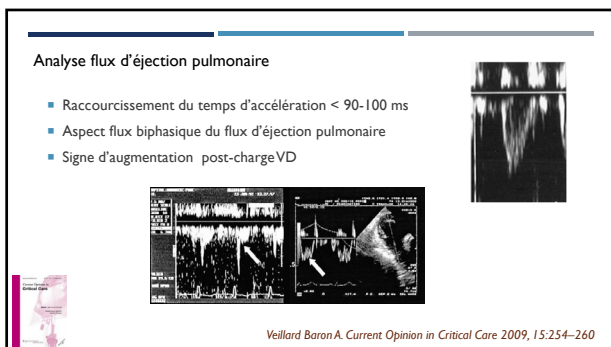
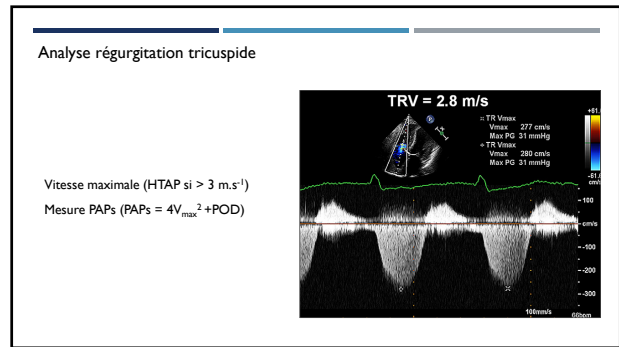
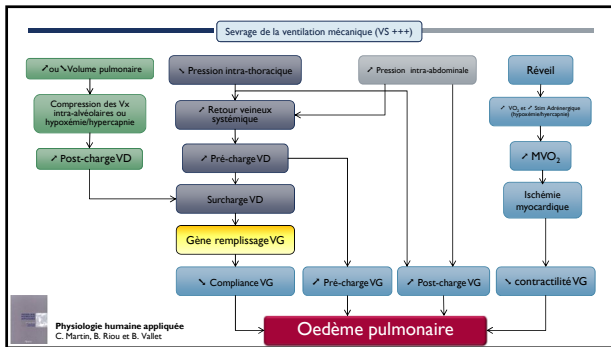
Lemaire F. et al. *Anesthesiology* 1988;69:171-9



Lemaire F et al. *Anesthesiology* 1988; 69:171-9

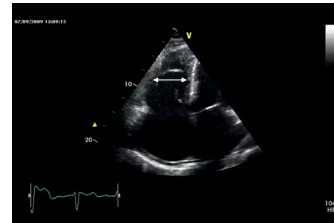






- 7 patients BPCO
- Sans dysfonction cardiaque gauche préalable
- Cathéter de Swan-Ganz
 - Augmentation PAP 25 à 28 mmHg au sevrage
 - Pas de modification significative FEVD 0,36 à 0,35
 - Volume télé-diastolique VD 117 à 126 ml**

Teboul JL, Intensive Care Med. 1988;14 Suppl 2:483-5



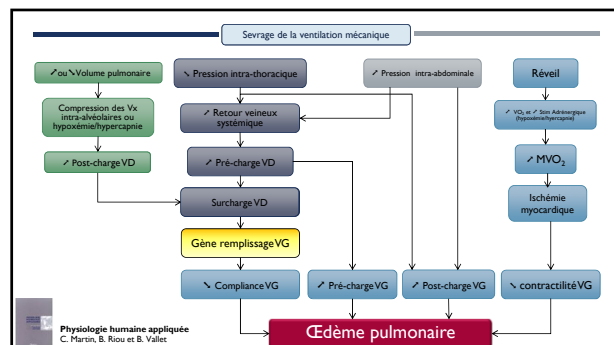
Incidence apicale 4 cavités



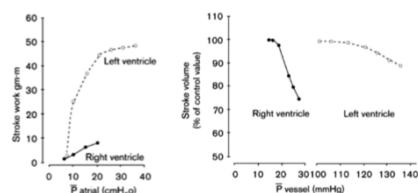
Incidence sous-costale 4 cavités (centrée sur VCI)

Table 3 Estimation of RA pressure on the basis of IVC diameter and collapse

	Normal (RA 0) mm Hg	Intermediate (5-10) mm Hg	High (15) mm Hg
IVC diameter	≤2.1 cm	2.1-3 cm	>3 cm
Collapse with sniff	>50%	<50%	<50%
Secondary indices of elevated RA pressure			• Right atrial filling • Tricuspid E/E' > 6 • Diastolic flow predominance in hepatic veins (systolic flow fraction < 50%)

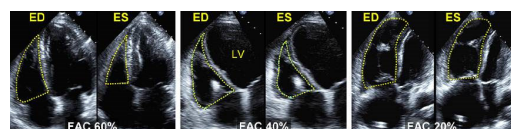


Réponse adaptative différente aux conditions de charge.....



Venturiuolo CE et al. Ann Am Thorac Soc 2014; 11:811-22

FRACTION DE RACCOURCISSEMENT DE SURFACE (FRS OU FAC)

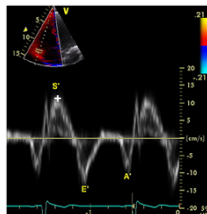


$$FAC = \frac{[STDVD - STSVD]}{STDVD} \times 100$$

(valeur normale = 50%)

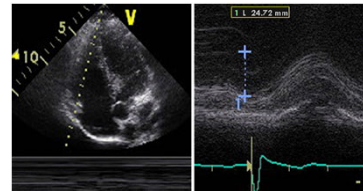
PIC VÉLOCITÉ SYSTOLIQUE À L'ANNEAU TRICUSPIEDIEN EN DOPPLER TISSULAIRE

(ONDE S')



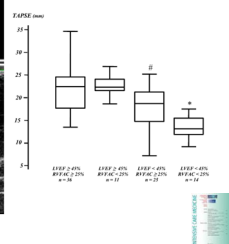
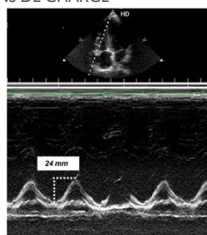
- Angle entre bord libre VD et curseur <30°
- Dysfonction VD si <10 cm/s

TRICUSPID ANNULAR PLANE SYSTOLIC EXCURSION (TAPSE)



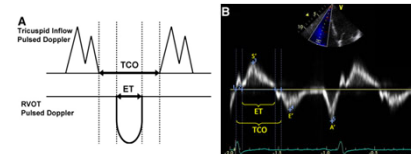
- Angle entre bord libre VD et curseur <30° (dysfonction VD si < 15 mm)

ANALYSE DU TAPSE POUR LA FONCTION VG AUX VARIATIONS DE CHARGE



Lamia B. Intensive Care Med. 2007 Dec;33(12):2143-9

INDEX TEI VD



$$\text{Tei index} = (\text{TCO} - \text{TE}) / \text{TE}$$

CALCUL TEI VD (MYOCARDIAL PERFORMANCE INDEX)

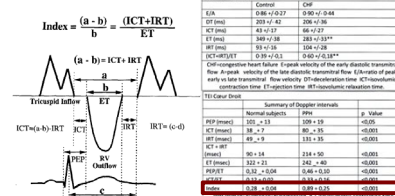
TEI Coeur Droit			
Summary of Doppler intervals			
	Normal subjects	PMH	p. Value
PEP (msec)	101 ± 13	109 ± 19	<0.05
ICT (msec)	38 ± 7	80 ± 35	<0.001
IRT (msec)	49 ± 9	131 ± 35	<0.001
ICT + IRT (msec)	90 ± 14	214 ± 50	<0.001
ET (msec)	322 ± 21	242 ± 40	<0.001
PEP/ET	0.32 ± 0.04	0.46 ± 0.10	<0.001
ICT/ET	0.12 ± 0.02	0.33 ± 0.16	<0.001
Index	0.28 ± 0.04	0.89 ± 0.25	<0.001

PMH primary pulmonary hypertension ET isometric relaxation time ET, aortic time

PEP, Primary pulmonary hypertension; ICT, isovolumetric contraction time; IRT, isovolumetric relaxation time; ET, ejection time.

Tei C. J Am Soc Echocardiogr 1996;9:838-47

CALCUL TEI VD (MYOCARDIAL PERFORMANCE INDEX)



TEI Coeur Gauche		
	Control	CHF
E/A	0.86 ± 0.27	0.90 ± 0.44
CT (msec)	26 ± 10	26 ± 10
ICT (msec)	43 ± 17	66 ± 27
IRT (msec)	348 ± 138	283 ± 135*
ET (msec)	418 ± 118	415 ± 118
ICT+IRT/ET	0.93 ± 0.71	0.65 ± 0.18**

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PEP, Primary pulmonary hypertension; ICT, isovolumetric contraction time; IRT, isovolumetric relaxation time; ET, ejection time.

Tei C. J Am Soc Echocardiogr 1996;9:838-47

FACTEURS PRÉDICTIFS DYSFONCTION VD

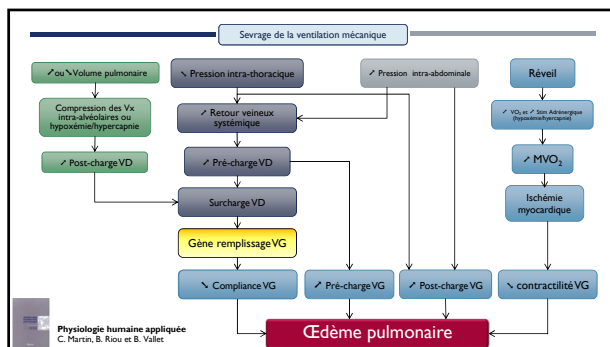
	Sensitivity (%)	Specificity (%)	ROC AUC (95% CI)
TAPSE <1.5 cm	59	94	0.82 (.68–.95)
DTI peak systolic velocity <10 cm/s	59	92	0.83 (.72–.85)
MPV > 0.40	100	35	0.8 (.69–.91)

- *MPI= myocardial performance index*

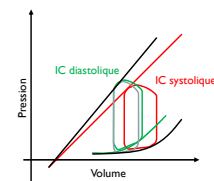
Variable	Unit	Abnormal	Illustration
Chamber dimensions			
RV basal diameter	cm	>4.5	Figure 2
RV subcostal	cm	>0.5	Figure 5
RV end-systolic wall thickness	cm	>0.5	Figure 6
RVOT PISA	cm	>0.5	Figure 8
dilat. chamber			
RVOT proximal diameter	cm	>3.3	Figure 8
RA major dimension	cm	>5.3	Figure 3
RA minor dimension	cm	>4.4	Figure 3
RA end-systolic area	cm ²	>18	Figure 3
Systemic function			
TAPSE	cm	<1.6	Figure 17
Pulsed Doppler peak velocity at the aortic pulvis	cm/s	<40	Figure 16
Pulsed Doppler peak velocity at the RV outflow	cm/s	<40	Figure 16
Tissue Doppler MPI		>0.50	Figures 16 and 18
Tricuspid flow	l/s	<35	Figure 9
Diagnostic function			
E/A ratio		<0.8 or >2.1	
E/E' ratio		>16	
Deceleration time (ms)	ms	>200	

FAC, Fractional area change; MPI, myocardial performance index; PLAX, parasternal long-axis; PSAX, parasternal short-axis; RA, right atrium; RV, right ventricle; RVD, right ventricular diameter; RVOT, right ventricular outflow tract; TAPSE, tricuspid annular plane systolic excursion.

J Am Soc Echocardiogr 2010;23:685-713



LA BOUCLE PRESSION / VOLUME



Echocardiographic diagnosis of pulmonary artery occlusion pressure elevation during weaning from mechanical ventilation*

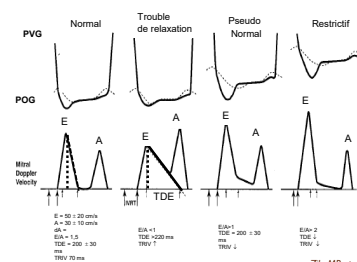
Bouchra Lamia, MD, MPH, PhD; Julien Maizel, MD; Ana Ochagavia, MD; Denis Chemia, MD, PhD; David Osman, MD; Christian Richard, MD; Jean-Louis Teboul, MD, PhD

- 39 patients en echec de mise en RS
- Augmentation PAPO chez 17 patients
- Analyse echographique

Bouchra L. Crit Care Med 2009;37:1696-1701



ANALYSE DU PROFIL TRANSMITRAL

Zile MR et al. *Circulation* 2002; 105:1387-1393

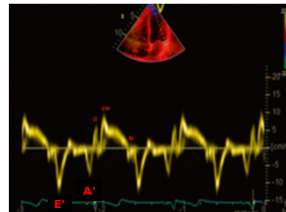
Flux transmitral et evaluation des pression de remplissage

Ajuster flux transmitral à un paramètre spécifique de relaxation

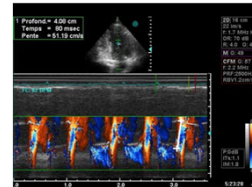
$$\frac{\text{Flux TM (E)}}{???} \approx \frac{\text{Relaxation}}{\text{Pression de remplissage}}$$

- Doppler pulsé tissulaire à l'anneau mitral (dTI)
- TM couleur de remplissage proto-diastolique du VG (Vp)

DOPPLER TISSULAIRE À L'ANNEAU MITRAL (DTI) APICALE 4 CAVITÉS



TM COULEUR DE REMPLISSAGE PROTO-DIASTOLIQUE DU VG (VP) APICALE 4 CAVITÉS

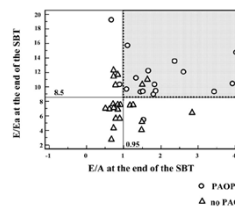


Trouble de relaxation si Vp < 45 cm/s

Peu utilisé

FONCTION DIAST	Normal	Pseudo-normal (type 2)	Anomalie relaxation (type 1)	Anomalie compliance (type 3)
Rapport E/A	> 1	> 1	< 1	> 2
Tps décélérat ^o onde E	160-240	160-240	> 240	< 160
TRIV (ms)	70-120	70-120	> 120	< 70
E/Ea	< 8	> 15	> 15	> 15
E/Vp	< 1.5	> 2.5	> 2.5	> 2.5
Rapport S/D	> 1	< 1	> 1	< 1
Durée Ap/Amit	A _{mit} > A _p	A _{mit} < A _p	A _{mit} > A _p	A _{mit} < A _p

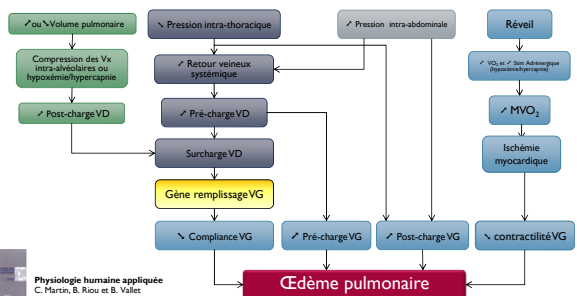
PRÉDICTION DE L'AUGMENTATION DE PAPO AU SEVRAGE



- E/A > 0.95 fin épreuve de RS de 1h
 - Élévation PAPO
 - Se 88%; Sp 68%
- E/Ea > 8.5 à la fin de l'épreuve de RS de 1h
 - Élévation PAPO
 - Se 94% Sp 73%
- La combinaison des 2 indices prédit l'augmentation de PAPO
 - Se 82%; Sp 91%

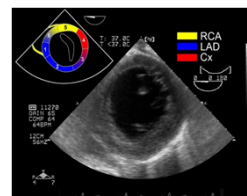
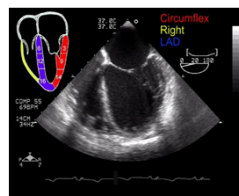
Bouchra L. Crit Care Med 2009;37:1696-1701

Sevrage de la ventilation mécanique

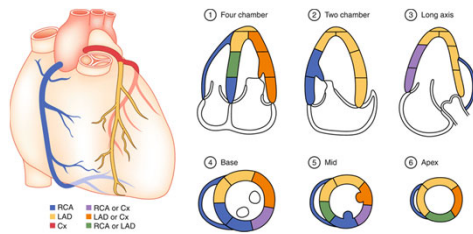


Physiologie humaine appliquée
C. Martin, B. Riou et B. Vallet

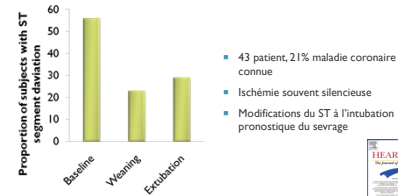
ANALYSE SEGMENTAIRE ETO



ANALYSE SEGMENTAIRE ETT



Prevalence of ST segment deviation



Frazier SK Heart Lung. 2006 Nov-Dec;35(6):363-73.

AUTRES ÉTIOLOGIES D'HYPOXÉMIE AU SEVRAGE DE LA VENTILATION

Intensive Care Med (2005) 31:734-737
DOI: 10.1007/s00135-005-2616-2

BRIEF REPORT

Chris Adamopoulos
Matthew Tsagourias
Konstantinos Arvanitis
Fotini Veroniki
Dimitrios Matamis

Weaning failure from mechanical ventilation due to hypertrophic obstructive cardiomyopathy

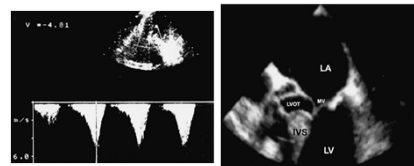
- Case report
- Modifications cardiaques liées aux conditions de charge et aux vitesses des flux

Adamopoulos C. Intensive Care Med (2005) 31:734-737

HYPOXÉMIE BRUTALE AU SEVRAGE DE LA VENTILATION

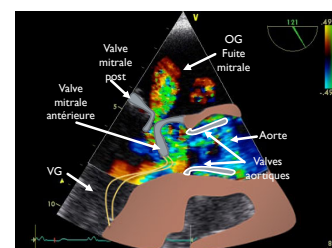
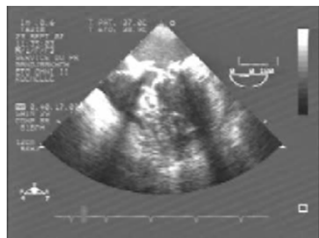
Obstacle dans la chambre de chasse:
Accélération du flux transaortique
(Vmax=4.81 m/s) . GRADmax=92 mmHg

Mouvement systolique antérieur de la grande valve mitrale



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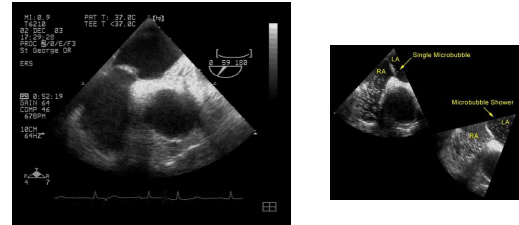
HYPOXÉMIE BRUTALE AU SEVRAGE DE LA VENTILATION



FORAMEN OVALE PERMÉABLE (FOP)



MANŒUVRE DE VALSALVA ET TEST DE CONTRASTE



EPREUVE DE CONTRASTE

- Distinction Foramen Ovale Perméable (FOP) et Shunt Intra Pulmonaire (SIP)
 - FOP : passage immédiat (moins de 3 battements cardiaques) des microbulles dans les cavités gauches dès leur apparition dans les cavités droites
 - SIP : passage retardé (plus de 3 battements cardiaques)
- Mais...
 - FOP > 3 battements si dépendant de la ventilation
 - SIP < 3 battements si proximal

CONCLUSION

- Le sevrage respiratoire peut être en échec dès les premières heures
 - Étiologie respiratoire
 - Modification des conditions de charge VG/VD +++
- ETT , ETO permettent d'évoquer le diagnostic
 - Rôle des indices combinés reste à valider dans cette indication
 - Limites classiques liées à une pathologie préexistante ou à des anomalies rythmiques
 - Cathétérisme de Swan-Ganz peut se révéler intéressant mais reste invasif
- Traitement vise à améliorer les conditions de charge
 - Déplétion hydrique, dérivés nitrés, inhibiteurs calciques, milrinone...