

ECMO podpora v těhotenství

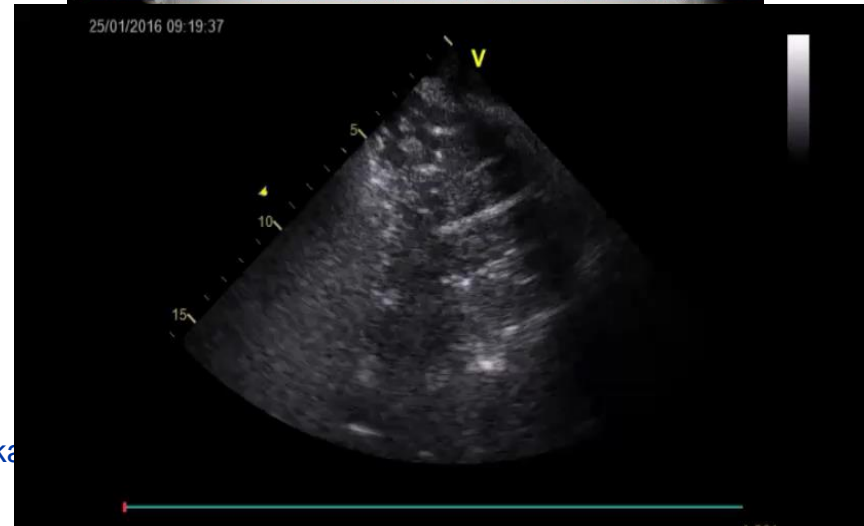
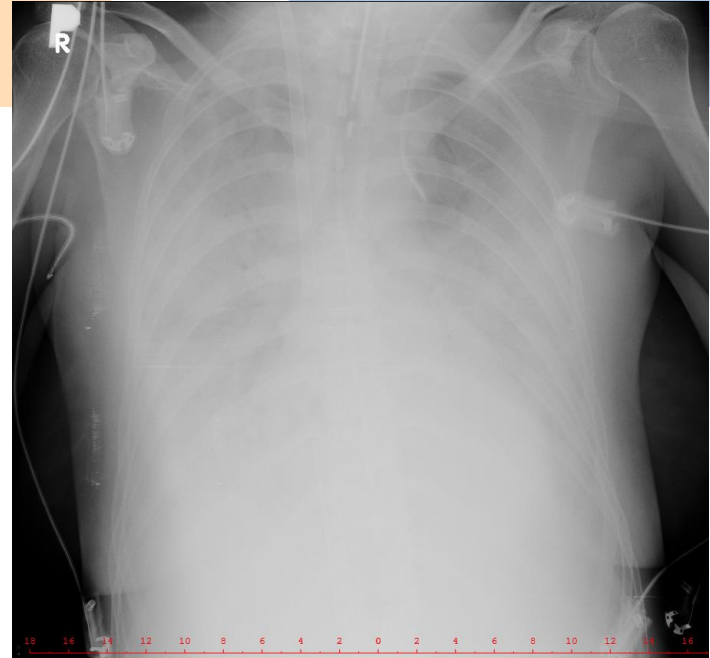
Martin Balík

KARIM VFN a 1. LF UK, Praha

Female 29 years, referred in 26th gestational week

- 5 days respiratory infect
- Bilat. bronchopneumonia in district hospital
- 6.day intubated, critical resp. insufficiency: Murray 4, $\text{paO}_2/\text{FiO}_2$ 53, PEEP_{ext} 16, Ppl 34 mbar, FiO_2 0.90, MV 12.5 l/min

- Inhomogeneous LUS
- Lat&Ventr gr.3 pattern
- Dorsal gr.4 pattern (consolidation)



Concept of bedside LUS and echocardiography

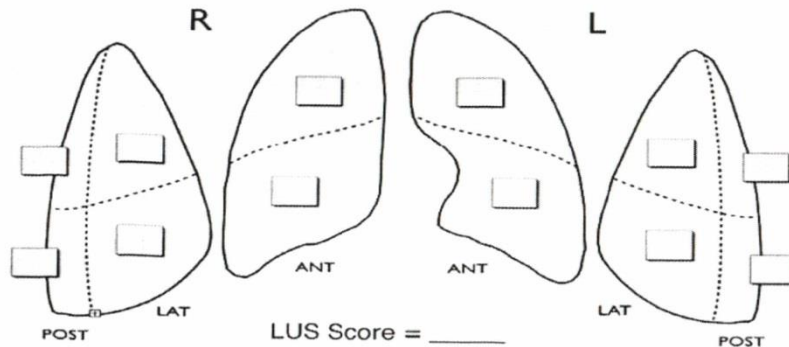
- LV function and determination of LVEDP/LAP, mitral valve
 - Differentiation of ARDS vs. cardiogenic lung edema
- RV dysfunction and assessment of pulmonary hypertension
- Preload
- Pleural pathology and lung parenchyma
- Ventilation strategy
- Patient positioning, proning, semiproning.....
- Indication to bronchoscopy
- Indication and contraindication of recruitment manoeuvres
- Detection of intracardiac shunts
- Decision for VV or VA cannulation



Systematic approach to chest US: 12 zones

LUNG ULTRASOUND	
Report Form	

PATIENT NAME: GENDER: ☐ M ☐ F DATE OF BIRTH:
 OPERATOR: EXAM DATE: HOUR: STORAGE CODE:
 HISTORY:
 SPONT VENTILATION: RR = Resp Distress: ☐ Yes ☐ No DECUBITUS: ☐ Sup ☐ Lat ☐ Pron ☐ Semirec
 MECH VENTILATION: a) Modality: ☐ PCV ☐ DuoPAP ☐ ASV ☐ PSV ☐ SIMV ☐ NIV ☐ CPAP
 b) Settings/Pattern: PEEP/Ps = / Ppeak Pplat RR I:E VT
 EGA/EAB: pH pCO2 HCO3- BE PO2 P/F SpO2% Hb
 INDICATION: ☐ DIAGNOSTIC ☐ SCREENING ☐ MONITORING ☐ PROCEDURAL GUIDANCE
 TYPE OF EXAM: ☐ simplified ☐ comprehensive ☐ focused (ANT / POST)



Legenda: 0 = A-Pattern (or nearly normal); 1 = B-Pattern (B-lines >3/field, well spaced); 2 = B-Pattern (crowded, coalescent +/- subpleural consolidations) 3 = Consolidation* E= Effusion*; Pn = Pneumothorax**;
 NS= Sliding Abolition; LP=Lung Pulse *(3 and E: characterize below in description) **(Indicate Lung Point(s))

DESCRIPTION

 DIAGNOSIS

☐ Suspected ☐ Not made ☐ Second Opinion needed

Signature _____

Right:

Upper: Ant – Lat – Post

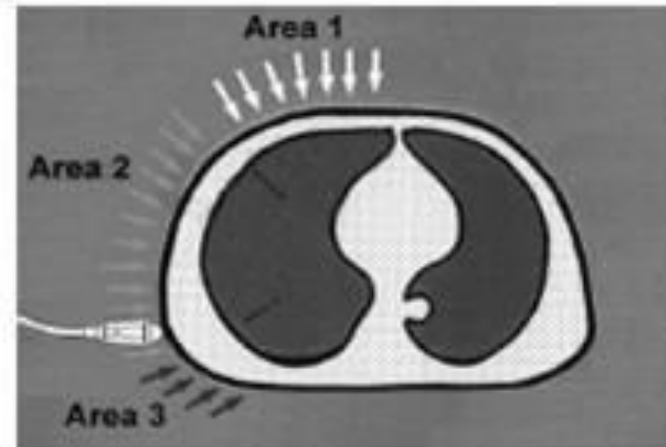
Lower: Ant – Lat – Post

Left:

Upper: Ant – Lat – Post

Lower: Ant – Lat – Post

(Via G, et al: Minerva Anesthesiol 2012)



Alveolointerstitial assessment

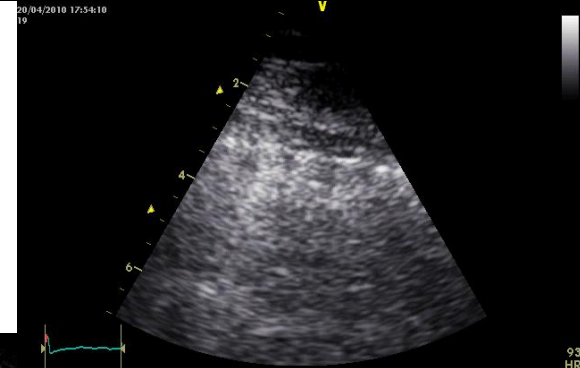
A line: reverberation of pleural line

B line: interlobular septa, >3....
accumulate fluid, 25-28%
above diaphragm on IPPV

- ALI, ARDS
- card. lung edema
- pneumonia
- chronic interst. process

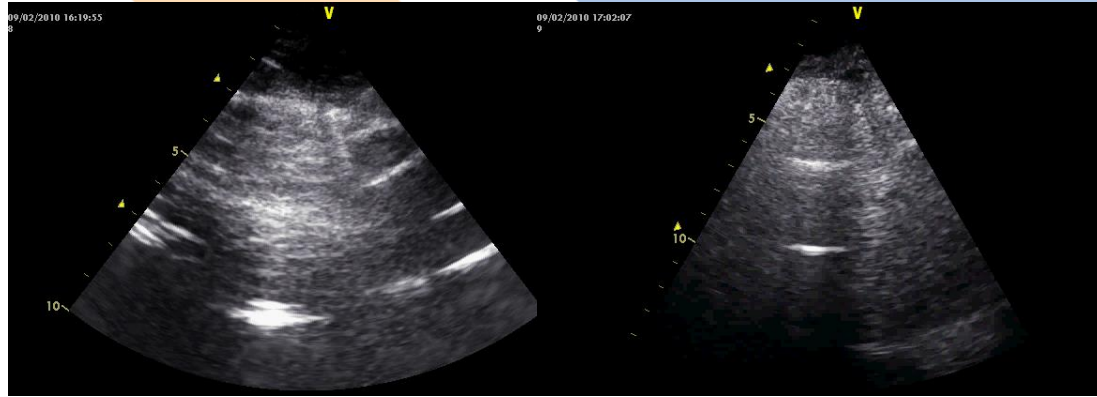
Heralds X-ray edema
(Badgett RG 1996,
Lichtenstein 2005, 2007)

Interstitial syndrome - grading

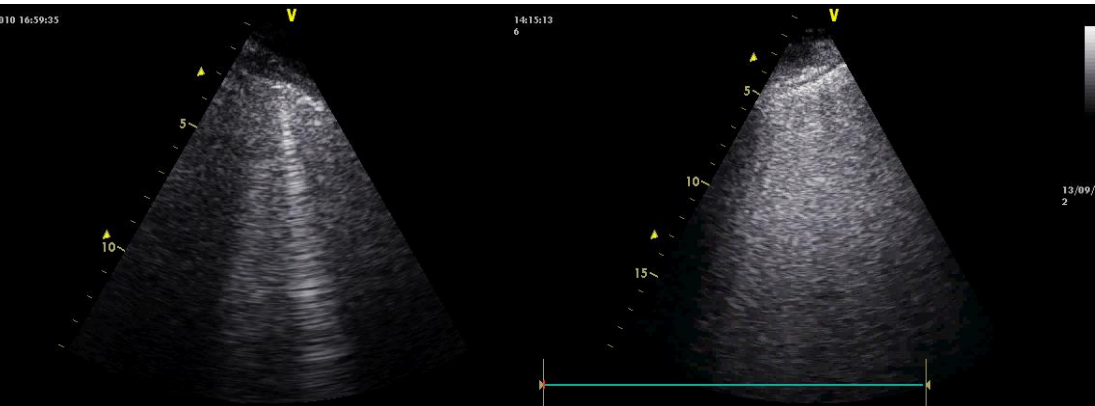


4 degrees of lung consolidation

I **(N)** – A lines, aerated lung, a comet, Z lines acceptable

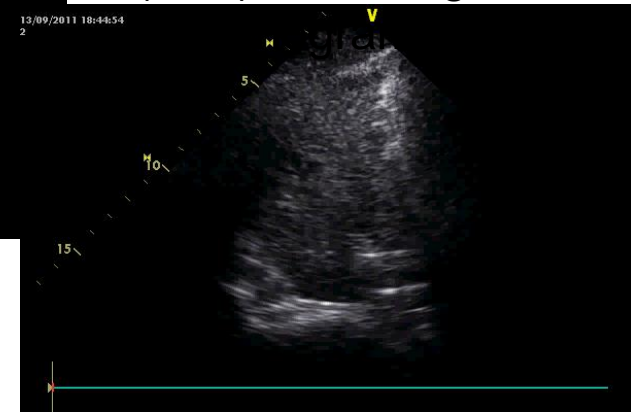


II **(B1)** - B lines, up to B4-7 mm, A line absent



III **(B2)** – B lines 3 mm to coalescent

IV **(C)** - Consolidation, dynamic bronchogram, diff dg. atelectasis with static (fluid) bronchogram



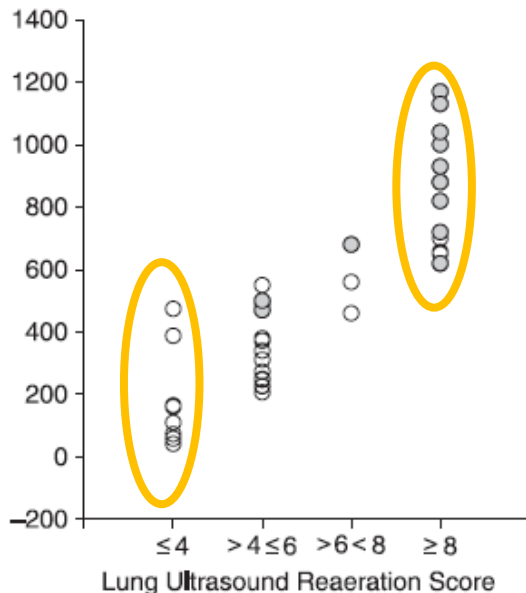
Estimate of lung recruitability and preload

TABLE 1. ULTRASOUND REAERATION SCORE

Quantification of reaeration*			Quantification of loss of aeration		
1 point	3 points	5 points	5 points	3 points	1 point
B1 → N	B2 → N	C → N	N → C	N → B2	N → B1
B2 → B1	C → B1			B1 → C	B1 → 2
C → B2					B2 → C

Definition of abbreviations: B1 = multiple well-defined either regularly spaced 7-mm apart or irregularly spaced B lines (moderate loss of lung aeration); B2 = multiple coalescent B lines (severe loss of lung aeration); C = lung consolidation; N = normal pattern (normal lung aeration).

B PEEP-induced Lung Recruitment (ml)

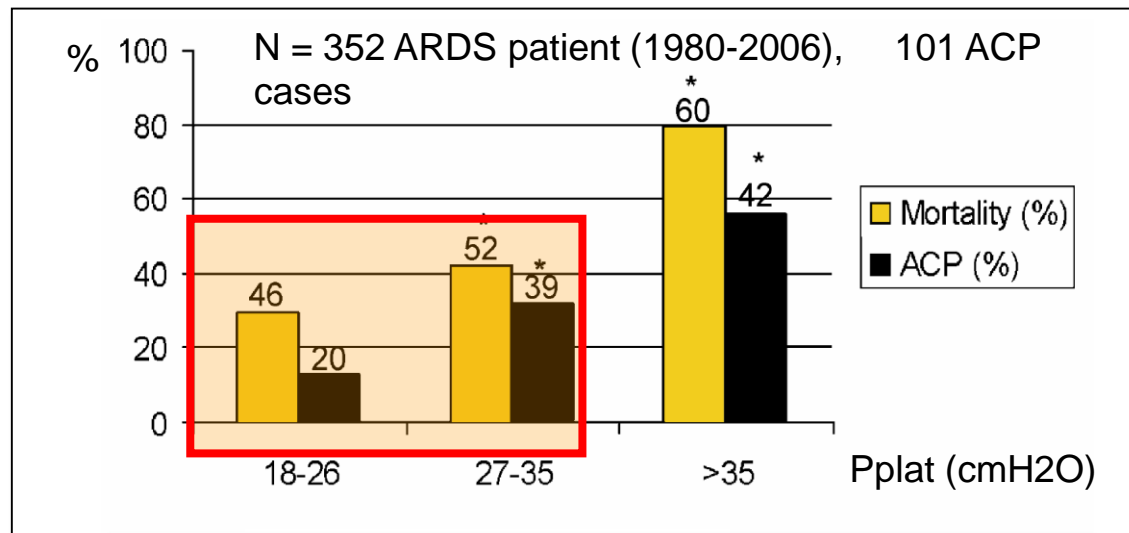


US reaeration score (40 pts ARDS,ALI):
 US a PV curves
 PEEP 015
 (Bouhemad B: AJRCCM 2011)

Recruitability II and III, seldom
 IV anterior and lateral
 Never IV basal and caudal !

Right ventricular failure: secondary to severe respiratory failure

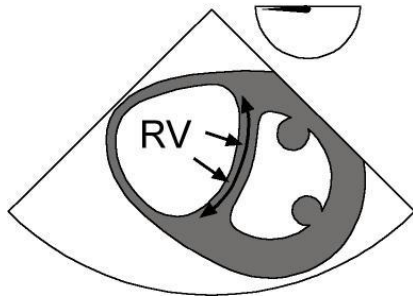
- ARDS: ACP up to 33% (Jardin F, Intensive Care Med 2007)
- Pplat < 27 mbar only 13%
- Survival on IPPV linear to EF_RV (Steltzer H: Anaesthesia 1994)
- Implications for cardiorenal syndrome (type IV) with renal congestion
- **ACP as a potential indication to VA-ECMO**



N = 352 ARDS patient (1980-2006), 101 ACP cases

ACP 13%
for Pplat < 27
cmH2O

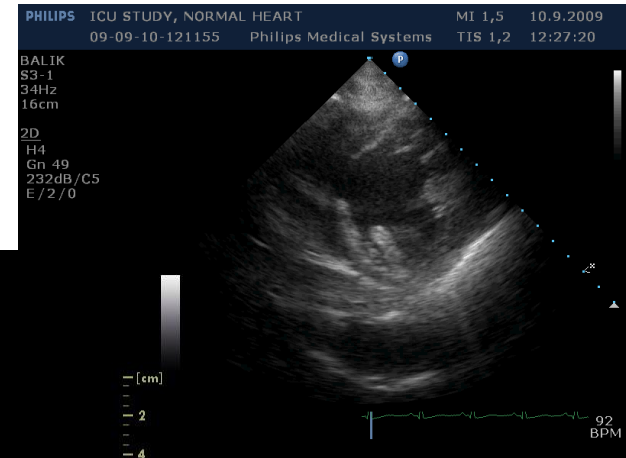
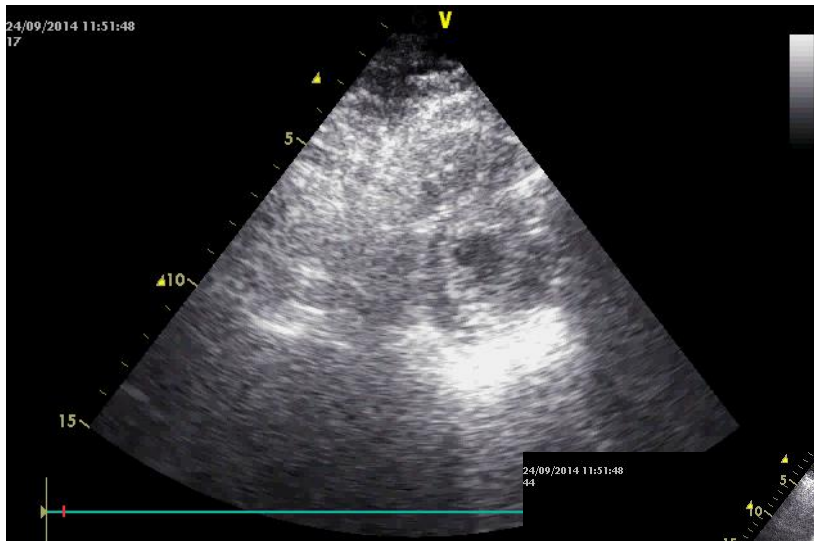
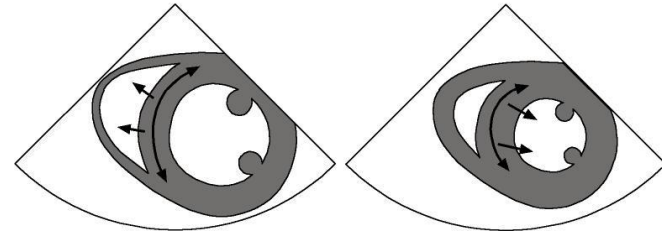
Diastole



ARDS and ACP = paradoxical septal motion in enddiastole

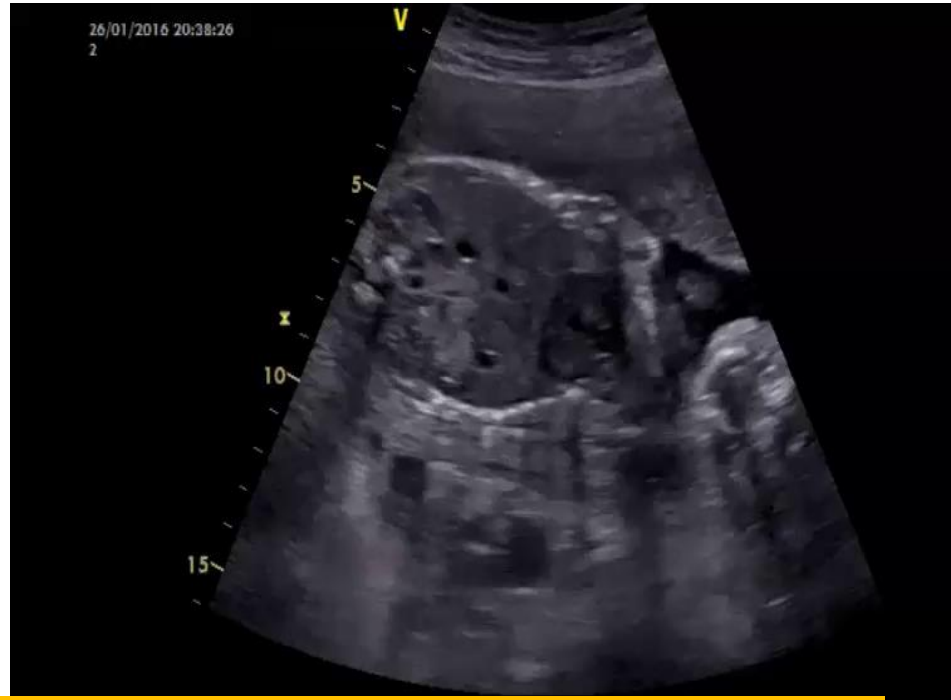
Diastole

Systole



26th week, so far physiologic pregnancy.....

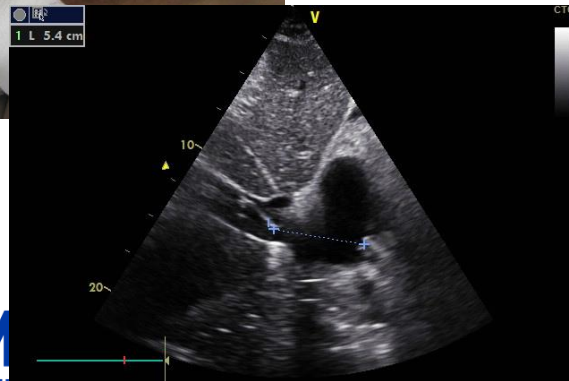
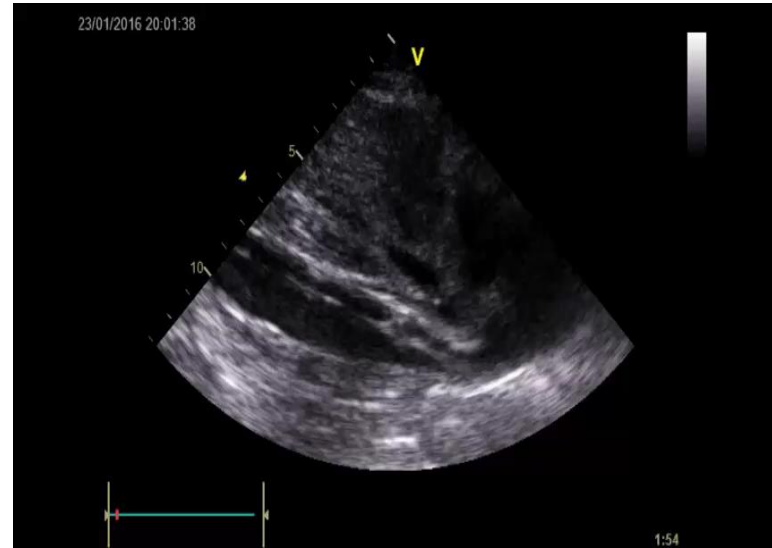
- Adequate development on US (Ob/Gyn), normal amniotic fluid
- Regular heart rate
- Placenta anterior wall
- 2 l ascites, hypotrophic left kidney with concrement in ureterovesical junction, right kidney hypertrophic, PCT 24 ul/l
- AKI (PCr 236 umol/l, PU 18 mmol/l)



Still conservative...?....or
would you suggest something
extracorporeal ?

VV-ECMO: SVC 21F, IVC 25F

- PSV 12 mbar, PEEP 10 mbar, RR 10-14/min
- SpO₂ 94-96% on FiO₂ 0.4, Vt 300-350 ml, Ppl<24 mbar
- TTE+TEE: no pathology on VV-ECMO



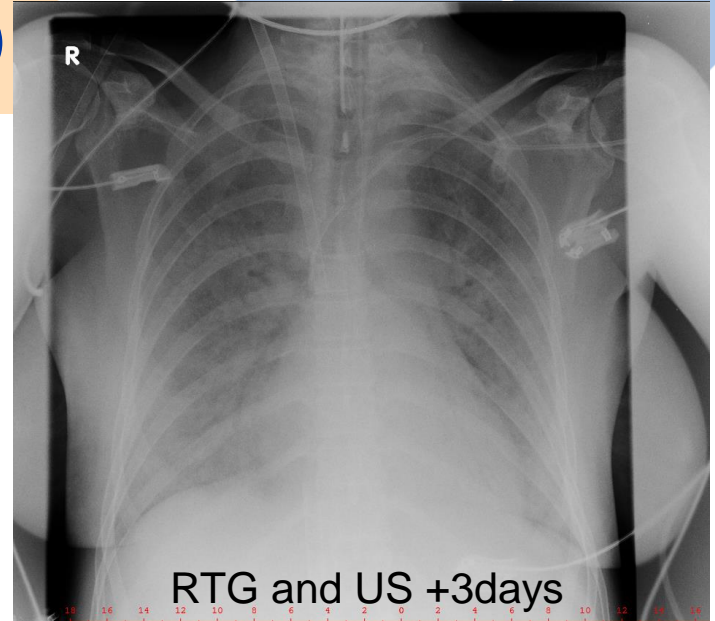
Fetal monitoring in the second trimester (26.w)

- CTG not feasible < 30 week (false neg or posit.)
- Daily US
- Other theoretical:
 - Cervicometry
 - Fetal fibronectin (FFN) in vaginal secretion - FFN 95% negative prediction of spontaneous delivery



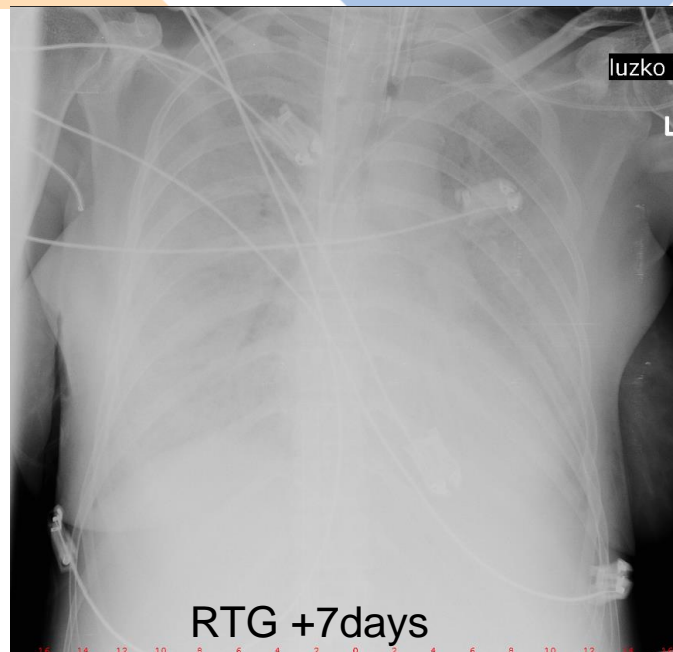
Therapy of primary ARDS (myxovirus A, hemoph.infl.)

- Tamiflu 150 mg q12h NG
- Relenza nebulised q6h
- Tazocin + Azithromycin
- Microbiol: Influenza A sputum
- Gradual improvement of Cdyn
- 4.dg. alveolointerstitic. syndrome...
-3.dg alveolointerstitic sy incl.
lung base
- Weaning of VV-ECMO
- 6.day inflamm. increase:
Tazo+Azithr changed for
Linezolid+Meropenem



Therapy of the primary ARDS

- GI tract deterioration and reduced intake of virostatics
- Rebound myxovirus A, confirmed in sputum
- NJ tube + syntostigmin
- Again fully dependent on VV-ECMO
- PDTS 9.day



Rebound of myxoviral infections

- WHO Guidelines, ELSO Guidelines
- Tamiflu (oseltamivir) TBL (150 mg q12h for 10 days)
 - Enteral intake and prokinetics
 - NJ tube
- Relenza (zanamivir) INHALATION (servonebulisation/spacer q6-8h)
- Rapivab (peramivir) I.V. (US FDA approval 12/2014, since 2017 available in Cz) – i.v.
- **Repeated screens for a myxovirus in bronchial aspirate q5 days during ICU stay, and before ceasing of the virostatic medication (WHO Guidelines)**

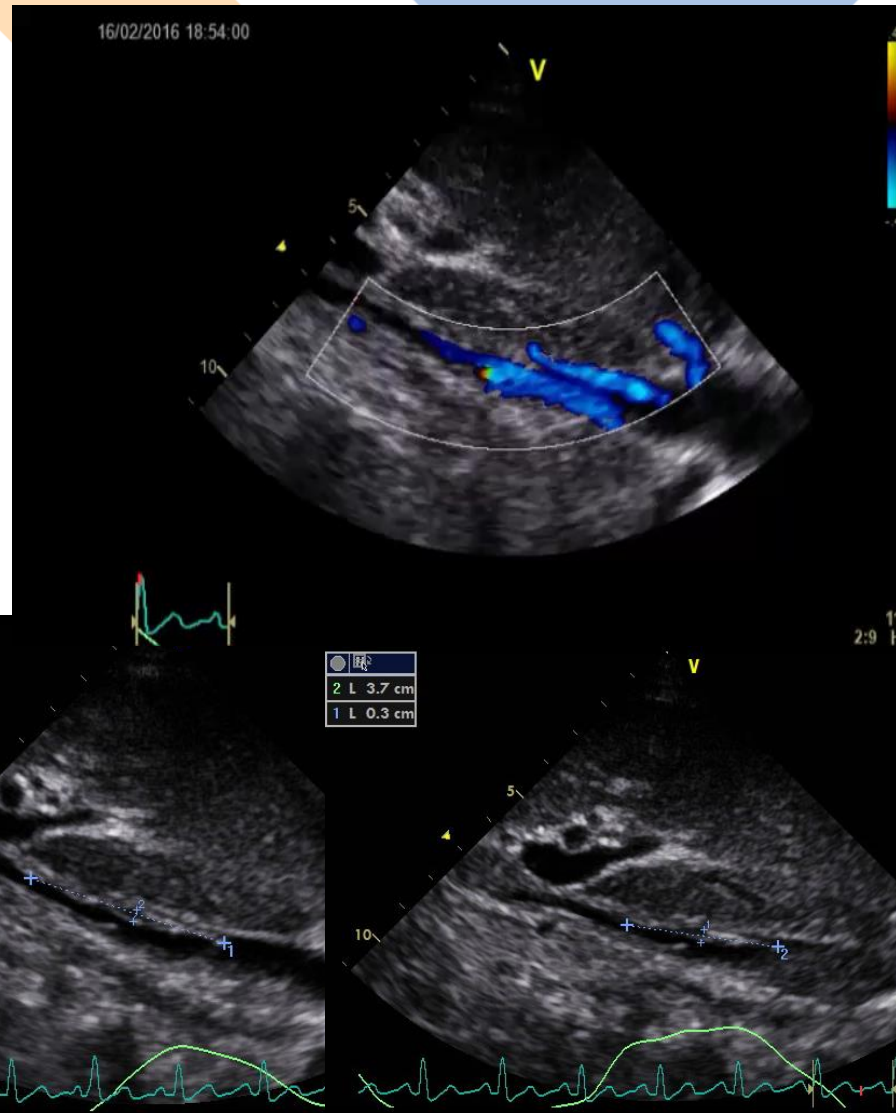


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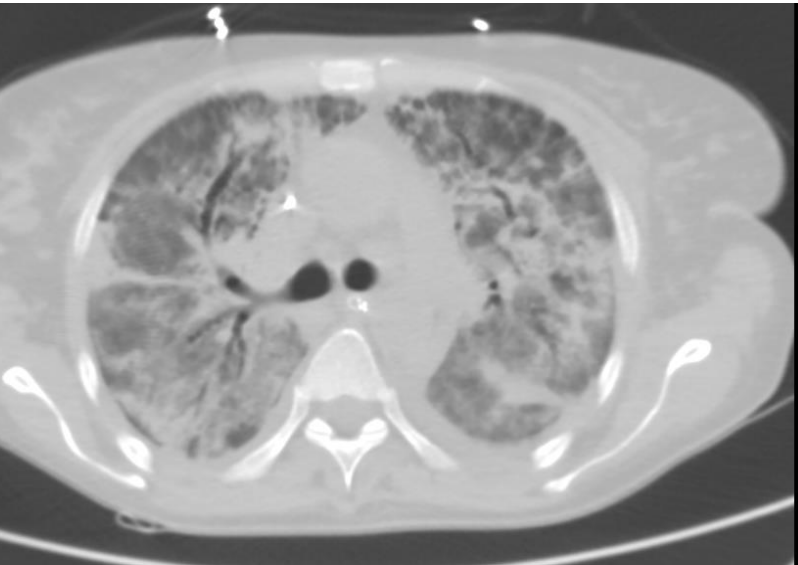


Therapy of primary ARDS and complications

- With established GI intake improved effects of the virostatics
- 16.day placental abruption and spontaneous delivery of dead baby
- Uterotonics (duratocin), bleeding stopped
- 17.day completed ECMO weaning and explantation
- TTE normal, postcannulation thrombi in IVC



Sepsis after ceasing of the VV-ECMO

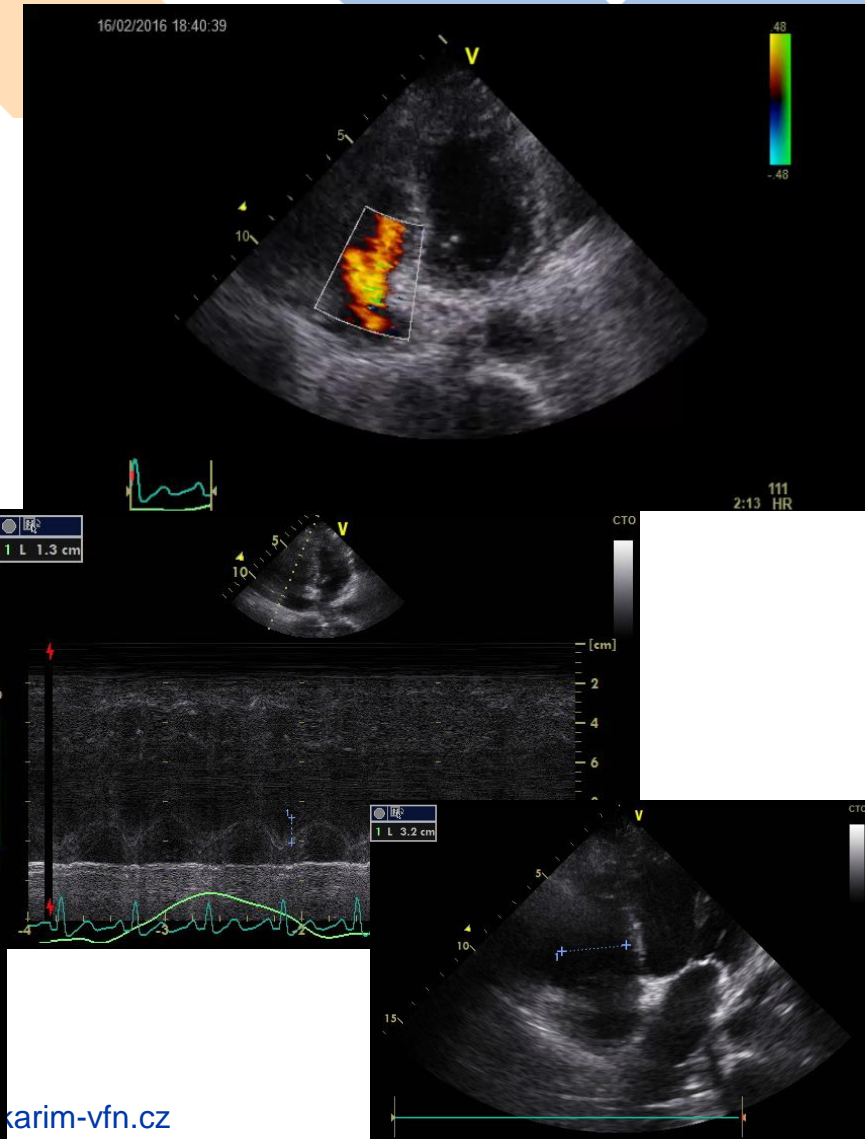
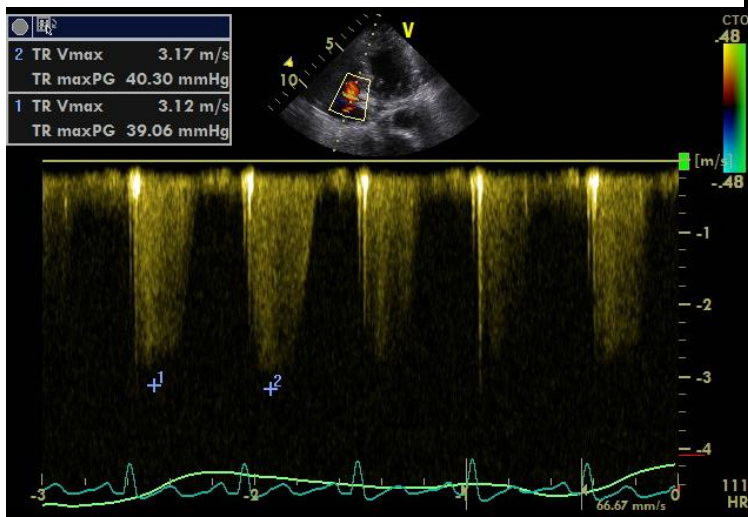


CT 19.day, sepsis,
PCT 73...93 ug/l !

- Primary myxovirus A and hemofilus infl. in sputum
- 16.day G+ cocci in blood cultures, Kl.pn aspirate only Coli+Tie
- 23.day rectal swab Kl.pn only Coli+Tie
- 29.day aspirate Kl.pn Coli+carbapenems
- 30.day ECMO cannula Kl.pn Coli+carbapenems
- 34.day urin cath + throat swab Kl.pn. Coli+carbapenems
- 37.day aspirate Kl.pn. Coli+carbapenems

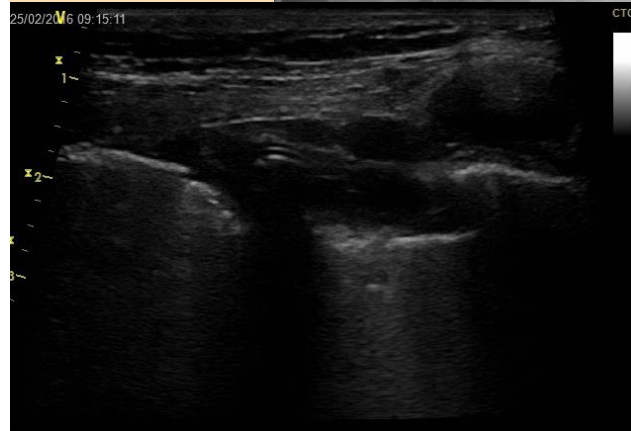
Complications after VV-ECMO explantation

- 20.day womb curettage due to sepsis and lochiometra
- Massive PE - thrombi in IVC
- Dilated RV, sinus tachycardia, BPs 60 mmHg, pH 7.10, paCO_2 14 kPa
- Urg. VA-ECMO, suction VJldx 21F, AFdx 19F, AFspfdx 7F

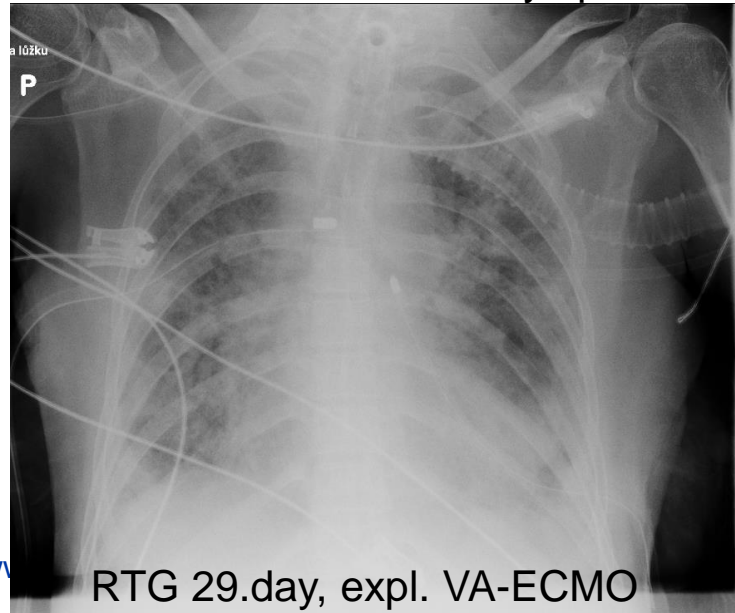


Further course

- Prompt stabilisation on VA-ECMO, PSV
- 23.day sufficient diuresis, CRRT ceased
- Myxovirus deff. neg.
- Virostatics stopped 23.day
- 24.day spont.R pneumothorax, prompt HD 20F
- 29.day completed weaning and VA-ECMO explanted



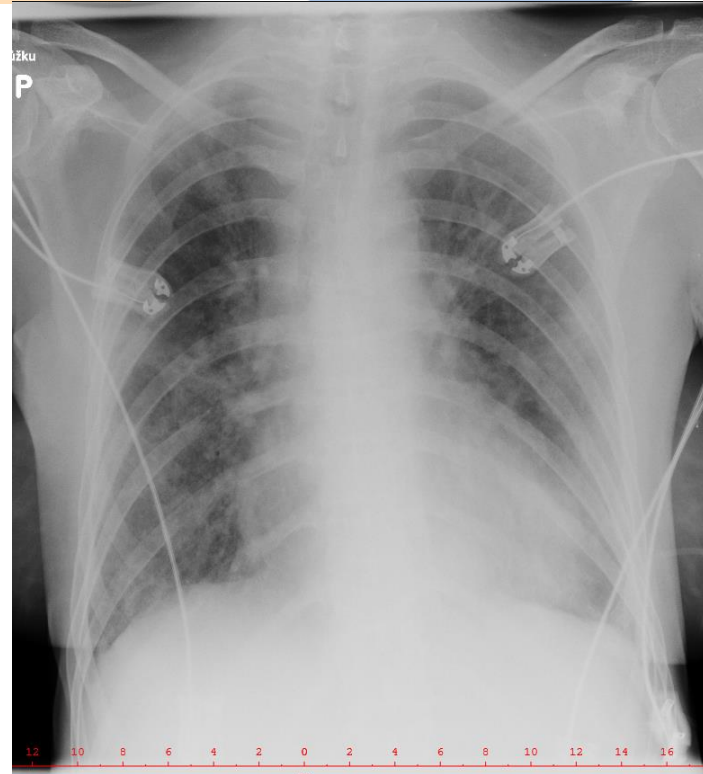
24.day spont PNO



RTG 29.day, expl. VA-ECMO

Further course

- US pelvic and legs with no thrombi
- Residual thrombi in IVC, normal TTE, caval filter not feasible
- F.V Leiden heterozygous, prothrombin mutation neg., PAI neg.
- 33.day rehabilitation on T-piece
- Postantib. colitis (CD Ag+Tx neg)
- 39.day decannulation
- 41.day discharged to regional hospital
- Full anticoag. for 3 months



Day of discharge from GUH

Extracorporeal Membrane Oxygenation for 2009 Influenza A(H1N1) Acute Respiratory Distress Syndrome

Critical illness due to 2009 A/H1N1 influenza in pregnant and postpartum women: population based cohort study

The ANZIC Influenza Investigators and Australasian Maternity Outcomes Surveillance System

The Australia and New Zealand Extracorporeal Membrane Oxygenation (ANZ ECMO) Influenza Investigators*

Context The novel influenza A(H1N1) pandemic affected Australia and New Zealand during the 2009 southern hemisphere winter. It caused an epidemic of critical illness and some patients developed severe acute respiratory distress syndrome (ARDS) and were treated with extracorporeal membrane oxygenation (ECMO).

CTG in the 3rd trimester

Risk of ARDS in myxovirus > 20.week (2nd trimester)

JAMA ANZICS 2009: 10 peripart., 7 survived, 3 ECMO children (all S.C.)

KARIM: repeated admissions of pregnant in 20-38th week

291 pts on ECMO, 4 Caesareans, 2 spont.abortions, 1 dead child delivery, 1 vital ICU delivery on ECMO at the 25th week....635 g...healthy 8y girl



Kunstyr J, Balik M, et al: Spontaneous delivery on VV-ECMO: Acta Anaesth Scand 2010

ECMO in pregnancy

Favourable factors: early indication to ECMO, viral pneumonitis, age

Unfavourable factors: bleeding, Caesarean and curettage, particularly in later stages of ECMO (> 5 days): acquired vWf dis. 93%, deficit of fXIII, thrombopenia.....versus gravidity as a thrombophilic state

Interrupting heparin feasible up to 48h (ECMO)

Delivery trigger (?): decidual bleed (?), foetal stress, intrauterine infection (? H1N1), systemic inflammation (?)



Provided informed consent

Conclusions

- Combination of bedside imaging plus ventilator data for setting of the IPPV strategy
- Attention to enteral intake of the virostatics, early indication to the NJ tube
- **VV and VA techniques not to be separated – unless ignoring couple of deaths in an ECMO Center annually**
- Anticoagulation on ECMO and after, screening for thrombosis, impact on follow up and continuing therapeutic anticoagulation (3 months).
- Caval filters – rarely for post-cannulation thrombosis in the IVC
- Foetal monitoring with the ultrasound



Děkuji za pozornost !

Complex Cardiovascular Center
1st. Medical Faculty of Charles University,
General University Hospital

U nemocnice 2; 128 08, Prague 2, EU

T: +420 224 962 243

F: +420 224 962 118

E: martin.balik@vfn.cz

www.karim-vfn.cz

