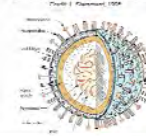


ECMO in the CVICU: "Bonding or Bondage"

Dr Paul Boucher
Chris Coltman RN
Steven Cornick RN

Influenza Virus

- RNA, enveloped
- Viral family: Orthomyxoviridae
- Size: 80-200nm or .08 - 0.12 µm (micron) in diameter
- Three types
 - A, B, C
- Surface antigens
 - H (hemagglutinin)
 - N (neuraminidase)



Haemagglutinin subtype				Neuraminidase subtype					
H1	*	*		*	N1	*	*		*
H2					N2				
H3					N3				
H4					N4				
H5					N5				
H6					N6				
H7					N7				
H8					N8				
H9					N9				
H10									
H11									
H12									
H13									
H14									
H15									
H16									

Influenza A Pandemics

•1918: **Spanish Flu** (H1N1)

•50 - 100 million deaths

•(67 000 Canadians)

•1957: **Asian Flu** (H2N2)

•1 - 4 million deaths

•(7000 Canadians)

•1968: **Hong Kong Flu** (H3N2)

•1 - 4 million deaths

•(3400 Canadians)

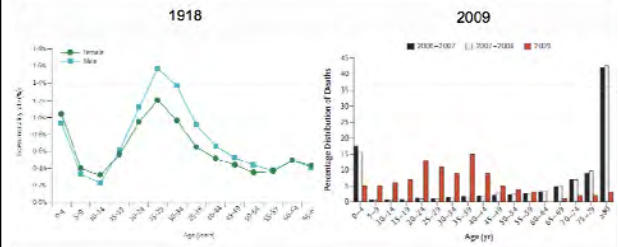


Why the fuss with H1N1?

- Generally less severe illness than seasonal influenza
- Lower clinical attack rate than anticipated
- Probably fewer deaths than seasonal influenza
- **Young & pregnant are more severely affected**



Age of Death During Pandemic



Mexico Epidemic: 6241 cases

The 'flu'



- Common symptoms
 - Chills
 - Fever
 - Sore throat
 - Muscle pains
 - Headache
 - Malaise

Influenza Pneumonia

- The most serious complication!



Influenza Pneumonia

- ARDS
 - Adult Respiratory Distress Syndrome
- ALI
 - Acute Lung Injury

ARDS

- Acute onset
- Bilateral infiltrates consistent with pulmonary edema
- $\text{PaO}_2/\text{FiO}_2 < 200$
- No clinical evidence for CHF as a cause for pulmonary edema

Care of the patient

- Supportive care
 - Intubation, mechanical ventilation
 - Low tidal volume
 - NIV?
- Some Patients are not supportable with conventional support
 - HFOV
 - Prone position ventilation
 - NO
 - APRV

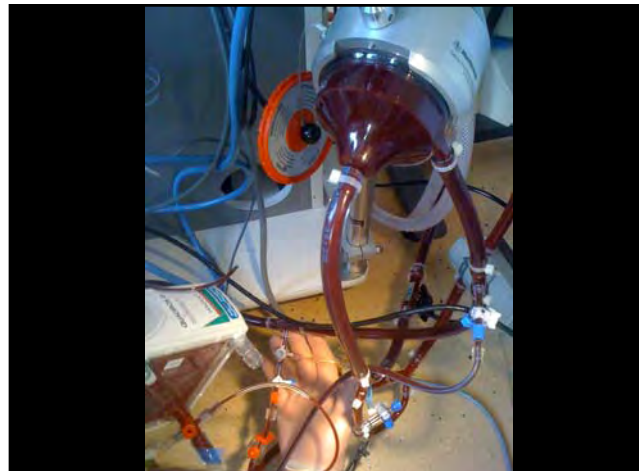
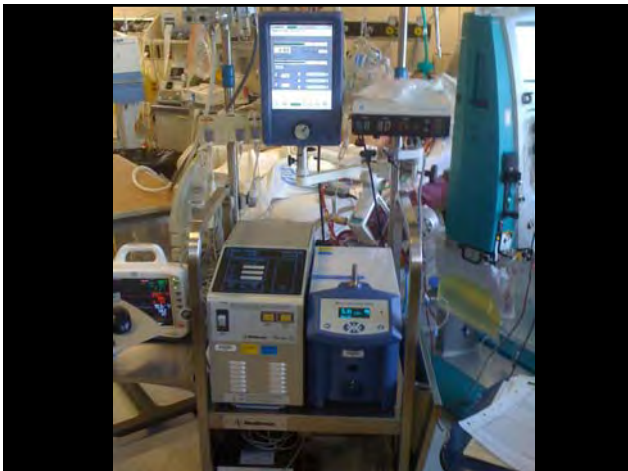


When all else fails

- Extra Corporal Life Support
 - ECLS
- Extra Corporal Membrane Oxygenation
 - ECMO
- Extra Corporal Lung Assist
 - ECLA

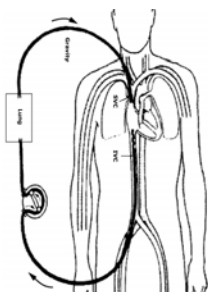
ECMO

- Nomenclature based on cannulation sites
 - VA – Veno Arterial
 - Support cardiac and/or pulmonary failure
 - VV – Veno Venous
 - Support pulmonary failure, without cardiac failure



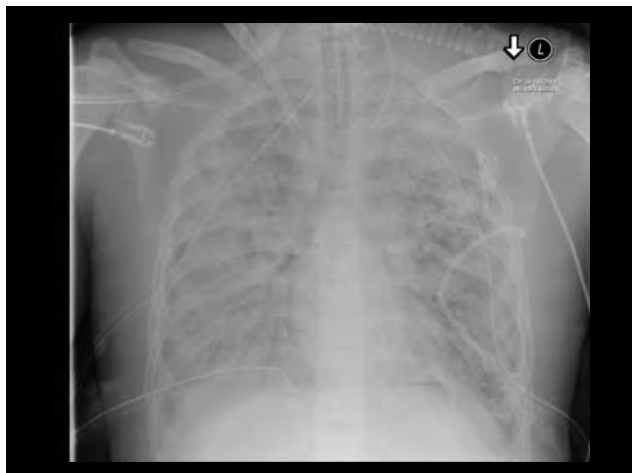
VV EMCO

- **pre-pulmonary Oxygenation**
 - impact intrapulmonary shunt
- goal flow: 50-100 mL/kg/min
- goal sats: > 80% - 85%
- (good Hb & cardiac output)



Pitfalls

- recirculation fraction - follow pre-membrane sats
- insufficient flow usually due to inadequate drainage
- often need multiple cannulation sites with large cannula (28-30 Fr)
- Equipment and personnel dedicated to Cardiac Surgery



Complications

- Bleeding
- Hemolysis
- Sepsis
- Thrombosis:
 - Emolic- pulmonary - paradoxical
 - Circuit
 - Limb
 - Vena Cava

VV ECMO

- To be considered when
 - Risk of death >50%
- Indicated when
 - Risk of death >80%

ARDS Severity

- P/F ratio <100
- pH<7.20
 - In spite of maximization of ventilator techniques
- Murray Score
 - Based on CXR, PEEP, PF, and compliance
 - 0 = No lung injury
 - 0.1 – 2.5= Mild to moderate lung injury
 - > 2.5= Severe lung injury (ARDS)

Murray JF, Matthay MA, Luce JM, Flick MR. An expanded definition of the adult respiratory distress syndrome. *Am Rev Respir Dis* 1988; **138**: 720-23.

FiO ₂	P/F	Murray Score	Mortality
> 90%	< 150	2 - 3	> 50%
> 90%	< 80	3 - 4	> 80%

Who does Poo-ryly?

- mechanical ventilation @ high settings > 7 days
 - FiO2 > 0.90
 - Pplat > 30
- immunosuppression (absolute neutrophil count < 400/mL3)
- recent/expanding CNS hemorrhage
- The obese (BMI>40)
- Necrotizing pneumonia



VV ECMO

- Treating to recovery
 - Transplantation is not a viable option for the most part
 - Very poor outcome
 - Average run 10-12 days

The Australia-New Zealand Experience

68 H1N1 patients on ECMO

Patients	68 (2.6/million)
Mean age	34.6 yrs
Male	50%
P/F ratio	59 ± 26
PEEP	17.2 ± 5.3 cm H2O
Duration of ventilation	2 days (IQR 1-5 days)
Cannulated at referring ICU	38 (78%)
ECMO duration	12.2 ± 7.8 days
Survived to discharge	48 (71%)
Died	14 (21%)

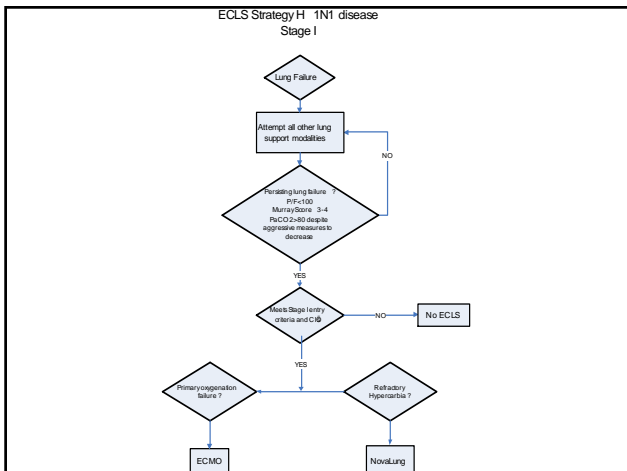
Pandemic Planning

- Reports and Literature from
 - Canadian experience in the spring
 - Southern Hemisphere
- Needed to plan to manage this finite resource
 - Calgary 2/4
 - Edmonton 3/5



Pandemic Planning

- Provincial working group established
- Document was created within a short time frame outlining
 - Indications
 - Contraindications
 - Exit strategies
 - Graded triage model

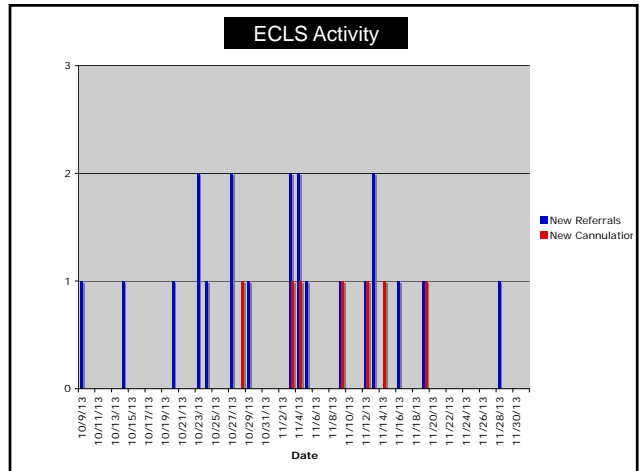


Pandemic Planning

- Stage I
 - No limitation of resources
 - Age <60
- Stage II
 - Some limitation of resources
 - Limits to Viral Pneumonia
 - Age <40
- Stage III
 - No resources



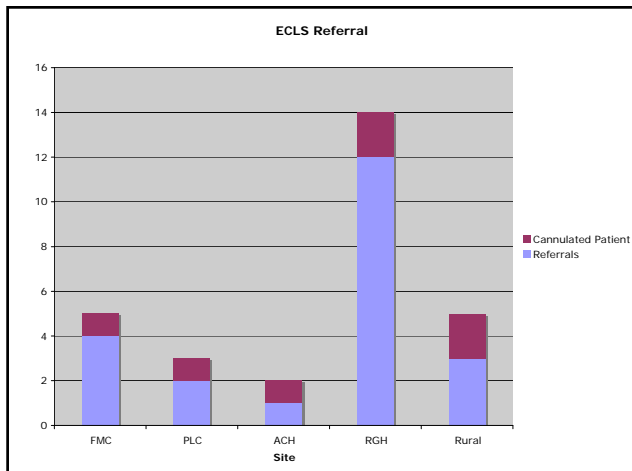
Local Experience



Cannulation Site	No.	Age (years)
FMC	3	31, 31, 33
PLC	1	23
RGH	2	33, 38
ACH	1	16
Maz / UAH	1	41
Stollery	2	4, 8
Saskatoon	1	4
Totals	11	range: (4 - 41)

Calgary H1N1 ECMO

- 22 Referrals
 - Oct 7- Nov 27
 - 1 for Cardiac support, all others for ALI
- Demographics
 - 15 male, 7 female
 - Age 35 (16-57)
 - P/F 95 (55-165)
 - MAP 25 (13-38)
 - Murray Score 3.24 (2-3.75)
- 7 Patients Cannulated



Calgary H1N1 ECMO

- 7 patients
 - All H1N1
 - Oct 22 to Nov 18
- 4 on at once
 - Cohorting patients
 - Even without knowing their H1N1 status!

Calgary H1N1 ECMO

Age	28 (16-38) yrs
Sex	All Male
ECMO duration	13 (5-33) d
Days of Ventilation Prior to Cannulation	0.7 (0-2) d
CRRT	71% (5/7)
Survival to Hospital Discharge	86%* (6/7)
PRBC	29 (2-75) units
Cannulated off Site	57% (4/7)

Complications

Days of Ventilation Post ECMO*	7 (2-21) d
Hemothorax	3/7
Line Site Bleeding	3/7
VRE Bacteremia	2/7

Questions?

