From ECLS to Home….  
The 2009 H1N1 Calgary Experience

Kari Litzenberger RN  
Unit Manager  
Chris Coltman RN, BScN  
Clinical Nurse Educator  

CVICU, Foothills Medical Centre, Calgary Alberta

Objectives

- To provide a brief overview of the 2009 H1N1 pandemic—what was it all about?
- To present the Calgary Pandemic Planning Experience—how did we get ready?
- To describe the H1N1 Experience in our CVICU—was it really that bad? How did we get through it?
- To explore the experience from a patient and family point of view—what was it like on the other side?
What is H1N1? Was it a big deal?

- A new strain of influenza causing a global pandemic
- First identified in Mexico April 2009, and then followed into the Southern Hemisphere – Australia May 2009, and then Canada
- WHO first declared H1N1 as a global pandemic June 2009
- First global pandemic since 1968 Hong Kong flu H3N2
- Similar to the 1918 “Spanish flu” H1N1 pandemic

“wine flu”
Why the fuss with H1N1?

*Targeted the healthy, young & pregnant (20-40 years old)

- Sickest - rapidly deteriorated

Was it a big deal in Canada?

*April 2009 – March 2010*

- 8669 Hospital admissions for H1N1
- 1472 ICU admissions = 17%
- 429 H1N1 related deaths = 5% of total H1N1 admissions
- Canadian average mortality rate/million = 1.26%
2009 H1N1 Pandemic Deaths Worldwide

<table>
<thead>
<tr>
<th>Country</th>
<th>Deaths</th>
<th>Deaths/million</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>429</td>
<td>1.26</td>
</tr>
<tr>
<td>Alberta</td>
<td>71</td>
<td>1.93</td>
</tr>
<tr>
<td>Mexico</td>
<td>995</td>
<td>0.94</td>
</tr>
<tr>
<td>Australia</td>
<td>191</td>
<td>0.87</td>
</tr>
<tr>
<td>France</td>
<td>265</td>
<td>0.44</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>411</td>
<td>0.67</td>
</tr>
<tr>
<td>United States</td>
<td>2491</td>
<td>0.81</td>
</tr>
</tbody>
</table>

November 2009

Brace for more H1N1 deaths, Canada’s top doctor warns

MORE ON THIS STORY
- Inside Alberta Politics: Troy Wright
- Union calls for clear plan on H1N1
- Flamingo cancels show
- Defamation lawsuit
- Pandemic worries mount
- Alberta health care system under strain
- Ontario health minister urges more
  swine flu vaccinations
- Pneumonia more common this year

November 2009

And So It Begins!
The ‘flu’

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

A/H1N1
Influenza Pneumonia

- The most serious complication!

ALI
- Acute Lung Injury
  - PaO2/FIO2 < 300

ARDS
- Acute Respiratory Distress Syndrome
  - PaO2/FIO2 < 200
ARDS

- Acute onset
- Bilateral infiltrates consistent with pulmonary edema
- No clinical evidence for CHF as a cause for pulmonary edema

Care of the patient

- Supportive care
  - NIV?
  - Intubation, mechanical ventilation
    (lung protective strategies)

- Some patients are not supportable with conventional support
  - Advance modes of ventilation
    - APRV, HFOV (High Freq Oscillation)
    - Prone positioning
    - NO
When all else fails…?

Extra Corporal Life Support (ECLS)

- Extra Corporal Membrane Oxygenation (ECMO)
- Extra Corporal Lung Assist (ECLA) - Novalung

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

Oxygenator →

ECMO pump →

← ECMO Pump

Oxygenator →
Complications

- Bleeding
- Hemolysis
- Sepsis
- Thrombosis:
  - Embolic - pulmonary
  - Circuit
  - Limb
  - Vena Cava

Who does Poo-rly on ECMO?

- mechanical ventilation @ high settings > 7 days
  - FiO2 > 0.90
  - Pplateau > 30
- Immunosuppression
- The obese (BMI>40)
- Necrotizing pneumonia
Pandemic Planning begins...

- Alberta Provincial Critical Care Network
  - Work focus became Pandemic Planning Spring 2009

- Reports and Literature Review
  - Southern Hemisphere
  - Canadian Winnipeg experience

Care of the Critically Ill SRI Patient Practice Guidelines

- Updated numerous times between April 2009-December 2009 as information changed
- 25 page document
- Included:
  - Indications
  - Contraindications
  - Exit strategies
  - Graded triage model
Pandemic Planning – *Graded Triage*

- **Stage I**
  - No limitation of resources
    - Age < 60

- **Stage II**
  - Some limitation of resources
    - Limit to Viral Pneumonia
    - Age < 40

- **Stage III**
  - No resources = *Not good!*

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Pandemic Planning…

- Recruitment of *retired* critical care nurses - re-orientated to the various Calgary ICU’s.

- **H1N1 webpage** area created on the Department of Critical Care Webpage

- N95 fit testing

- Training for Extracorporeal Lung Assist (Novalung) for ICU nurses
Pandemic Planning…

- Mobile ECMO transport team plan created
  - Cardiac Surgeon, Cardiac Anesthetist, 2 Cardiac OR nurses, Intensivist, 1-2 perfusionist(s)

- Purchased another ECMO machine

- Needed to plan to manage this finite ECLS resource **run by perfusionist 24/7**
  - Calgary 2/4, Edmonton 3/5
  - Cohorting of ECMO patients?
and a little more Pandemic Planning…

• ‘H1N1’ 4 bed room prepared
  – 4 monitors & 4 Computer stations installed
  – Supplies acquired: beds, ventilators, suction, chairs, etc.
  – Planning with pharmacy, Baxter pumps reprogrammed

• Planning and implementation of staff immunizations, when, where, how …

Pandemic Planning

• Communication was key!
  – Website, emails, meetings
  – Videoconferences, teleconferences
  – Provincial ICU telehealth installed to facilitate provincial communication between ICU’s

• Ad-hoc provincial telehealth calls
  – referral sites, Edmonton – ECMO cases discussions

• Daily H1N1 ICU updates provincially
Calgary H1N1 ECLS

22 Referrals between Oct 7- Nov 27

- Demographics
  - 15 male, 7 female
  - Age 35 (16-57)

- 7 Patients Cannulated

Calgary H1N1 ECLS

- 7 patients
  - Admitted between Oct 22 - Nov 18
  - All H1N1

- 4 patients cohorted on ECMO simultaneously

Even without knowing their H1N1 status!
Oct 30 “Hinee” headquarters is open for business!!
### Calgary H1N1 ECLS

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

### Complications

<table>
<thead>
<tr>
<th>Days of Ventilation Post ECLS*</th>
<th>7 (2-21) d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemothorax</td>
<td>3/7</td>
</tr>
<tr>
<td>Line Site Bleeding</td>
<td>3/7</td>
</tr>
<tr>
<td>VRE Bacteremia</td>
<td>2/7</td>
</tr>
</tbody>
</table>
ECLS in the CVICU

Challenges...

- Cohorting
- Environmental
- Physical
- Mental/psychological/emotional
- Impact to cardiac surgery schedule

Cohorting Challenges

- Need for pooling of resources and expertise
- Lack of ideal space (for modified droplet isolation)
  - Inadequate isolation rooms
  - Optimally: neg pressure room (CVICU: None)
  - Next, private room (CVICU: 1)
  - Created an enclosed 4 bed ward on 10th floor
  - Next best: eventually built walls in CVICU
    “Hoarding”
  - Staffing (RNs/RTs/Perfusionists/Intensivists) concerns
  - In a post cardiac surgical ICU
- Planning for the unknown
**During a crisis in the ICU setting, it has been shown that staff distress is more likely to occur when there are **unexpectedly high demands placed on them which are unmatched by appropriate resources**”

Environmental Challenges

• The ‘HINI’ Room:

  Different floor than main CVICU
  • Required “runner” to:
    – Had to get some meds from main unit, bring pharmacy print outs, get supplies

  Unfamiliarity
  • Not usual bedside carts or supply carts

  “Relatively” small
  • Cramped, not enough room

Environmental Challenges con’t

• The ‘HINI’ Room:

  Poor ventilation
  • Hot, stifling atmosphere + PPE

  Housekeeping issues
  • Delays in floor cleaning
  • Garbage piling up

  Noise level
  • Hard to communicate & concentrate

  Room Temperature
  • Heat from equipment and wearing of PPE
Crowd Control!

- At times +++ staff in room:
  - Minimum: 7
    - 5 RN's
    - 1 RT
    - 1 perfusionist
  - Maximum: during MD rounds: 15 add:
    - Other MDs including surgeons and or Fellows Consults,
    - extra RT, Charge Nurse, curious bystanders, family members

- Add frequent “visitors” for portable tests:
  - X-ray, ECG, lab
- Tremendous difficulty in transporting to CT!!
Physical Challenges

- Constant wearing of Personal Protective equipment:
  - Gowns
  - Gloves
  - N95 masks
  - Face shield/goggles
  - Hats
  - hot, claustrophobic, "can’t get enough air", difficulty in communicating, took time to “Don” & “Doff”, “The Hinee Nose”, raw hands, headaches, dehydration

- Always “heavy” patients with equipment at different levels
  - Hard on back
  - Lots reaching/straining
Physical Challenges con’t

- Nursing care
  - Very complex, multisystem issues
  - Multiple tasks
    - CRRT mixing bags
    - Medication mixing (often with unfamiliar concentrations and dosages)
    - ++ dressings
    - Basic care was increased in complexity

- Infection control/cross-contamination challenges
Human Factors: Potential for errors?

- “Can’t see the forest through the trees..”

Medical Director Paul Boucher recognized huge potential for errors

Human Factors Consultant came in to assess “H1N1 HQ”; recommendations:
  - Store medications in a more accessible location
  - Ensure consistent verbal and written methods to communicate patient locations
  - Create color coding method
Emotional/Psychological Challenges

- The patients were mostly young, without significant co-morbidities
  - Not usual demographic for CVICU
  - Family centered care-crisis management
    - Family fearful and overwhelmed

- Staff Morale

- Social work
  - Family
    - Comfort in ability to see patient
    - Apprehensive in donning of PPE
    - Needed education and continual updates

“The psychological impact of a pandemic on health care workers can be significant...staff can be left feeling fearful for their own and their family’s health; stigmatized, alienated and isolated; and in some cases can be left suffering post-traumatic stress disorder”

How did the staff RESPOND?

Amazing team work!

- Individual members: RN’s, RRT’s, MD’s, Perfusionists, Physio’s, RD’s, Housekeeping, Pharmacy, IT department, CNE, Managers, (and others**) all came together as a cohesive unit
- All staff went “above and beyond”
- Morale stayed high despite long, difficult hours in “that Room”
- Professional growth
- We felt we were special
- Above all, feeling of accomplishment
A sense of humour was key....

Quotes from Staff

- “it feels like I’ve been to war”
- “very challenging medically with multi system involvement”
- “PPE’s are draining... physically and emotionally drained at the end of shift”
- “claustrophobic environment and very HOT”
- “unable to get away... for even a drink of water”
- “it was hell”
- “it was insane, no other word for it”
- “a great team building event with the multidisciplinary team!”
Case Study

Patient #3 admitted to CVICU November 3rd

- 23 yr old male presented at Innisfail Hospital (rural AB) November 2nd, with 3-4 day hx of flu-like symptoms
- BSA 2.45 BMI 37
- Quickly transferred to Peter Lougheed Hospital in Calgary for worsening dyspnea
- HFO, CT X 2 (pneumomediastinum)
- Foothills ECMO mobile team mobilized November 3
- Very difficult cannulation
- Patient transferred to FMC, CVICU
Case Study cont’d

- +++sedation/narcotics/paralytics and +++volume required to maintain ECMO flows
- Packing to rt IJ attempted cannulation site
- CRRT started November 10th (Creatinine 314) on for 9 days
- Remained in CVICU for 18 days
- ECMO removed Nov 16 (on X14 days),
- Transferred to ward Nov 20
- Discharged home December 1st
Cody and Amanda’s perspective:

- Could not believe he could not walk
- Difficulty talking, only able to whisper
- They both could not say enough thanks to the team
- Bonded with other H1N1 family members
- Only negative feedback they had was no follow-up after he was discharged home, ulcer back of his head
- Any lingering effects?
email September 20th...
“Just got these from the photographer. Enjoy and share with the staff... without your team our day wouldn't have happened let alone been PERFECT!!”
Amanda

Special Thanks to:

Cody and Amanda

CVICU team

Paul Boucher, CVICU Medical Director

Caroline Hatcher, Executive Director
Critical Care
Any Questions?

Alberta Health Services