Transport of the Critically Ill Children

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Conflict of Interests

Financial conflict

nil.

no conflict with private company
governmental grant re: ECMO transport

Scientific conflict

several abstract and articles re: transfer medicine
Backgrounds

Transport medicine is one of the crucial, but a neglected medical field. Without expert personnel, adverse events are high because of the complexity of critically ill patients particularly in children.

The difficulty of transport and the lack of adequate technology are used as excuse for giving up kids’ life and resulted in death.
Contents

✓ Principles of Patient Transport
✓ Dimension of critical care medicine
✓ Dimension of emergency medicine
✓ Multidisciplinary team
Contents

✓ Principles of Patient Transport
✓ Dimension of critical care medicine
✓ Dimension of emergency medicine
✓ Multidisciplinary team
Principles

- Patient stabilization
- Technology / Monitoring
- Multidisciplinary team
- Communication / Information
- Risk management
- Selection: Land or Air
Principles

✔️ Patient stabilization

It is the responsibility to the referring hospital to use its best available resources to stabilize a child prior to transport.

Medical advice from receiving hospital and/or stabilization procedure by transport team may be asked by referring hospital.
Principles

✓ Patient stabilization

✓ Technology / Monitoring

ECG, SpO2, NIBP, invasive pressures (ABP, CVP, ...)

Capnography is essential for intubated patient

non-invasive measure of ventilation and cardiac output

early recognition of DOPE

May need blood sampling and testing

Don’t forget to measure body temperature
Principles

- Patient stabilization
- Technology / Monitoring
- Multidisciplinary team

Physicians (attending and / or trainee)
Registered nurses
Medical Engineering
Surgeon should be a friend
Principles

- Patient stabilization
- Technology / Monitoring
- Multidisciplinary team
- Communication / Information

Which information should be provided, and how?
Principles

✓ Patient stabilization
✓ Technology / Monitoring
✓ Multidisciplinary team
✓ Communication / Information
✓ Risk management

Preparation for trouble, resuscitation, and death
Caution for medico-legal issues, and insurance
In-hospital vs. Inter-hospital

• For any procedure or test that requires travel outside of ICU, the clinician must weigh the risks and benefits to the patient.

• Inter-facility transport carries additional potential risks for healthcare providers and other individuals.
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## Difficult transfer, Cannot transfer

<table>
<thead>
<tr>
<th></th>
<th>diagnosis</th>
<th>distance</th>
<th>T/F team</th>
<th>Outcome</th>
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<tr>
<td>1</td>
<td>ARDS, H1N1</td>
<td>50 km</td>
<td>○</td>
<td>Difficult transport</td>
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<tr>
<td>2</td>
<td>ARDS, H1N1</td>
<td>30 km</td>
<td>○</td>
<td>Difficult transport</td>
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<tr>
<td>3</td>
<td>Acute myocarditis</td>
<td>30 km</td>
<td>×</td>
<td>Soon after arrival ➔ ECPR</td>
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<td>ARDS, pneumonia</td>
<td>60 km</td>
<td>○</td>
<td>ECMO @ referral site</td>
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<tr>
<td>5</td>
<td>ARDS, RS virus</td>
<td>30 km</td>
<td>○</td>
<td>ECMO @ referral site</td>
</tr>
<tr>
<td>6</td>
<td>PPHN</td>
<td>20 km</td>
<td>○</td>
<td>Cannot transfer</td>
</tr>
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<td>ARDS, AML</td>
<td>40 km</td>
<td>○</td>
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<tr>
<td>8</td>
<td>ARDS, ALL</td>
<td>40 km</td>
<td>○</td>
<td>Cannot transfer</td>
</tr>
<tr>
<td>9</td>
<td>ARDS, pneumonia</td>
<td>50 km</td>
<td>×</td>
<td>Cannot transfer</td>
</tr>
</tbody>
</table>

Kodani, JSICMr 2014

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Counter measures against late referral

Note, we lost many lives of sick children because we did not have ECMO transport system.
Two Decades’ Experience with Inter-facility Transport on Extracorporeal Membrane Oxygenation

Pediatric respiratory inter-facility ECMO transport was safe and significantly improved survival ratio.
ECMO transport team

✓ Should be *multidisciplinary* team
✓ Implement ECMO at referring site
✓ *Surgeon* should be your friend
✓ Prepare for everything

= *be prepared for unexpected issue*
Intra-facility ECMO transport
Prodhan P, et al.
Intra-facility ECMO transport

St. Thomas and Guy’s Hospital
London, UK
From In-hospital to Inter-hospital
Clement KC, et al.

Tokyo Metro. Children’s Medical Centre
Tokyo, JAPAN

Department of Paediatric Emergency & Critical Care Medicine, Tokyo Metropolitan Children’s Medical Centre, JAPAN
Preparation

• Logistics
• Equipment
• Team
  – Intensivist, Nurse, Surgeon, Clinical Engineer
• Referring Center
  – Acceptation by IRB on Feb.27, 2014
Logistics short – distance by land
Logistics long – distance by air
Logistics for special situation

HFOV and iNO

Japan Air Self-Defense Force C-130 mobile ICU Unit

Osamu Saito, 2014
Special Equipment

ECMO Transport Console

Department of Paediatric Emergency & Critical Care Medicine, Tokyo Metropolitan Children’s Medical Centre, JAPAN
Simulation

TMCMC Member Simulation at Nippon Medical School Hosp. ER

NMSC Member Simulation At Tokyo Metro Children’s Hosp
On site ECMO implementation
Support on site with IT
Surgeon should be there
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EMS systems in Japan

EMS systems are pretty different from those in other countries. Japanese EMTs cannot offer advanced procedures for children less than 15 years old. They cannot intubate them, cannot insert intravenous/intraosseous needles, cannot defibrillate manually, etc. Because of these circumstances, our emergency division started physician dispatch transport services to the scene.

Some emergency institutions are holding physician directed helicopter services. We have been cooperated with this advanced transport systems for paediatric trauma cases.
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Inter-hospital Paediatric (infant) ECMO Transport
First successful case in Japan
Inter-hospital Paediatric (infant) ECMO Transport
First successful case in Japan

@ Aichi Children’s

In the Ambulance
Ongoing issues

- Payment
- Medico-legal
- Disaster settings
- Education of transport medicine
Summary

Transport is a neglected aspect of care in many areas of the world owing to lack of resources. However, transport for critically ill children is warranted and improvement of outcome was indicated.

Transport systems for critically ill children should be improved with critical care and emergency medicine aspects and multidisciplinary fashion.