Blood Transfusion on Cruise Ships; A 36 month Review of Preliminary Data

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Background Information

- **Average length of cruise**
  - 7 days

- **Royal Caribbean**
  - 2010 – 4.5 million guests
  - 2011 – 4.8 million guests
  - 2012 – 4.9 million guests

- **34 Ships in Fleet**
  - Royal Caribbean International
  - Celebrity Cruises
  - Azamara Club Cruises

- **Capacity**
  - 700 to 6300 guests

- **Snapshot**
  - 99,000 guests
  - 37,000 crew

- **Medical Staff**
  - 74 Physicians
  - 127 Nurses
Oasis of the Seas
Decision Context

- Severe hemorrhage at sea is a challenging problem.
- Storing O Negative blood is not practical.
- Safe blood not readily available, universally.
- Plasma expanders of limited value.
- Blood substitutes are not ready for patient use.
- Use of on board blood donors is a solution.
- Possibly combined with anti-fibrinolytic agents.
- Only used in life-threatening situations.
Case Study: Mr Richard Kearns

- 76 year old male with prior Hx of GI bleed.. Same place !!!
- Wife is ICU nurse.
- Takes Plavix/ASA for ACS/ Stent/Lopressor
- Presented with active arterial bleed and initial Hb was 7.4 grms/dl.
- Given total of 4 units on board.
## Clinical Summary

<table>
<thead>
<tr>
<th>Time</th>
<th>B/P</th>
<th>Pulse</th>
<th>Hb</th>
<th>HCT</th>
<th>Platelets</th>
<th>Rx</th>
</tr>
</thead>
<tbody>
<tr>
<td>19.05</td>
<td>100/60</td>
<td>73</td>
<td>12.2</td>
<td>38.0</td>
<td>241K</td>
<td>TXA</td>
</tr>
<tr>
<td>20.00</td>
<td>93/62</td>
<td>70</td>
<td>9.9</td>
<td>31.7</td>
<td>265K</td>
<td>Fluid</td>
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<tr>
<td>20.30</td>
<td>83/60</td>
<td>72</td>
<td>9.6</td>
<td>31.0</td>
<td>250K</td>
<td>PPI</td>
</tr>
<tr>
<td>21.00</td>
<td>80/62</td>
<td>100</td>
<td>LOC</td>
<td></td>
<td></td>
<td>Blood</td>
</tr>
<tr>
<td>22.00</td>
<td>100/62</td>
<td>75</td>
<td></td>
<td></td>
<td></td>
<td>Blood</td>
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<tr>
<td>00.15</td>
<td>108/57</td>
<td>70</td>
<td>10.0</td>
<td>32.3</td>
<td>196K</td>
<td>Blood</td>
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<tr>
<td>05.00</td>
<td>104/60</td>
<td>79</td>
<td>7.4</td>
<td>30.7</td>
<td>169K</td>
<td>Blood</td>
</tr>
</tbody>
</table>
Mr Kearns presents to medical facility at 19.00 hrs 1.28.2013

01/28/2013 1900 (ship time) – Mr. Kearns at Medical Facility

01/29/2013 0656 – Evacuation from Vessel
Closest hospital with emergency gastroscopy: Hospiten Cancun
RV with Mexican Navy patrol boat from Isla du Mujeres 07.00 hrs
36 month experience with shipboard blood transfusion at RCCL

- Patients enrolled in study: 37
- Guests: 34  Crew: 3
- Haemaglobin range: 4.0 – 10.6 grm/dl
- Mean Hb on presentation: 5.96 grm/dl
- Units given per patient range: 1 – 6 units
- Deaths: 5
- Lost to follow up: 4
- Sero-conversion at follow-up: 0
- Transfusion/allergic reaction: 1 ???
Implementation of Transfusion System

- Heavy focus on training shipboard medical teams.
- As of April 1\textsuperscript{st}, trained 250 medical personnel.
- Initially provided supplies for 2 units of blood.
  - Citrated blood collection bags.
  - Eldon cards for blood grouping.
  - Rapid screen HIV & Hepatitis tests.
  - Required to call Med Ops 24 hour line prior to starting.
  - Clinical audit of all blood transfusion cases.
  - Mandatory follow up of all patients for 12 months.
RCCL Blood Transfusion Kit
Blood Transfusion Process on RCCL

- Early patient preparation – VITAL !!
- Consent signed.
- Blood group determined with Eldon Cards.
  - Donors identified, in order of preference:
    - Family members
    - Sexual partners
    - Guests who are known blood donors with cards
    - Guests who are blood donors, without cards
    - Medical team members
    - Crew
I understand that, as the ship does not carry blood onboard, my only alternative is to receive a blood transfusion from a volunteer passenger or member of the ship’s crew. I understand that, as the ship is at sea at the time of my transfusion, the blood provided by the volunteer passenger or crew member will be unable to be tested for the presence of communicable diseases, included but not limited to, hepatitis and/or the HIV / AIDS virus, and/or any other diseases which may be transmitted by or contracted through the blood.

I understand in general what a blood transfusion is, the procedures that will be used, the benefits of receiving a transfusion, as well as the possible risks, including but not limited to, allergic reactions, fever, transfusion-related acute lung injury, hemolysis and/or volume overload. The ship doctor has explained these risks to me and answered any questions that I had.
Considerations for blood donors

- Free of known blood borne diseases
- Good venous access – 16g needle !!
- Stable H/H, if donor is anemic or has sickle cell, Thalassemia or any other related disorder they cannot donate.
- No donors from HIV endemic regions or with any history of hepatitis or other infectious diseases.
Determining donor/recipient compatibility

- Eldon cards provide relatively quick & simple guide.
- Uses agglutination process to identify blood group.
- Also identifies Rh factor.
- Rapid HIV & Hepatitis test of donors.
Interpretation of Eldon Cards

Directions for Determining Your Blood Types
ELDONCARD 2511 for one blood typing inside the ABO- and Rhesus-D Systems.

1. Fill in the data of the person being tested.
2. Fill a glass with water. Suck a small amount of water into the micro-dropper and release one drop onto each of the coloured magnetic spots on the EldonCard.
3. Twist off little green protective lancet cap. Place the lancet upon a table.
4. To relieve the skin put the hand in warm water for 2 minutes. Dry the hand, disinfect a finger with the cleansing swab and let the finger dry.
5. Press the blood towards finger tip. Repeat pressing until a drop with a 3 to 4 mm (1/8 in.) circle diameter is seen. Drop the blood upon an EldonStick. Place the stick onto the first circular field (see fig. 6). The blood shall touch the water already present. Alternatively ask a friend to massage your finger. You can now use your free hand to hold the EldonStick.
6. Repeat the procedure shown in fig. 5 and 6 three times using the remaining EldonSticks. Keep each stick inside its own field.

7. Stir the blood in the first field with the EldonStick. To dissolve the agglutinogen. Air appox. 10 sec. Then spread the blood to cover the entire field. Repeat the procedure in the remaining fields using their own sticks. The blood must not clot. Begin the mixing within two minutes after the blood was applied onto the first EldonStick.
8. The contact between the red blood cells and the agglutinogen might cause the cells to clump into a gummy structure known as an agglutination. To develop all possible agglutinations the card must be tilted at least 40 seconds. Tilt the EldonCard to an upright position and wait 10 sec. A wave of blood will move the red cells slowly to the bottom of the fields. Tilt to the opposite vertical position and wait another 10 sec. while the blood flows down the fields. Tilt twice more on the remaining edges for 10+10 seconds. The result can now be read and recorded. Let the EldonCard dry at room temperature.

How to read the results
The presence or absence of agglutinations will show the Blood type. The possible combinations of agglutinations and the corresponding blood types are shown in the table.

Any test producing a weak agglutination must be repeated. If an agglutination is seen in the control field, the examination has to be repeated using washed blood cells. This requires lab equipment and the help of a technician.

EldonCards are delivered in moisture proof bags or envelopes. EldonCards exposed to the air must be used within the same day.
<table>
<thead>
<tr>
<th>BLOOD GROUP</th>
<th>ANTI-A</th>
<th>ANTI-B</th>
<th>ANTI-D</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Pos</td>
<td><img src="BLOOD-A-Pos.png" alt="Image" /></td>
<td><img src="BLOOD-A-Pos.png" alt="Image" /></td>
<td><img src="BLOOD-A-Pos.png" alt="Image" /></td>
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<tr>
<td>A Neg</td>
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<td>B Pos</td>
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<td>AB Pos</td>
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<td>AB Neg</td>
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<tr>
<td>O Pos</td>
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</tbody>
</table>
RCCL Clinical guidance

- Early preparation of patients and ID donors.
- Tranfuse to hemodynamic parameters – not Hb.
- Reverse anti-coagulants if possible.
- Consider anti-fibrinolytics.
- Do not over-resuscitate with fluid.
- Concept of “permissive hypotension”.
- Transfer to tertiary center, able to treat.
Avoid helicopter transport......
Conclusions

- Blood transfusion is a useful option for cruise ships.
- Informed consent by patient is required.
- Lives have been saved where MEDEVAC was not an option.
- Training and recurrent training for staff is critical.
- Clinical audit and patient follow up is important.
- Fresh, whole blood is not only a resuscitation adjunct, but therapeutic.
Acknowledgements

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Monica Wuerth, EMT CARE Team, RCCL

AND of course, RCCL Shipboard medical teams