Prevention of transfusion-transmitted arboviruses in French Polynesia

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French Polynesia (FP)

Arboviruses

Arboviruses (ARthropod-BOrne viruses)

**Alphavirus genus**
- Chikungunya virus (CHIKV)
- Ross River virus (RRV)
- ...

**Flavivirus genus**
- Dengue virus (DENV-1, DENV-2, DENV-3, DENV-4)
- West Nile virus (WNV)
- Yellow fever virus (YFV)
- Japanese encephalitis virus (JEV)
- Zika virus (ZIKV)
- ...
Pacific: a high endemic area for arboviruses

Cao-Lormeau VM, Musso D. The Lancet 2014

Legend

- Dengue virus
  - Orange: serotype 1
  - Green: serotype 2
  - Red: serotype 3
  - Blue: serotype 4
  - Black: not available
- Zika virus
- Chikungunya virus

Pacific: a high endemic area for arboviruses

Musso D, Cao-Lormeau VM, Gubler DJ. The Lancet 2015, in press

Arboviruses and blood transfusion

- West Nile virus +++
- Dengue virus (underestimated +++)
- Colorado tick fever virus
- Tick-borne encephalitis virus
- Others ?
Blood transfusion during arbovirus outbreaks in FP: the challenges

The challenges of blood transfusion in FP and other remote areas:
- Geographic isolation
- Impossible to be supplied by other blood bank centers
- Impossible to stop blood collection during an outbreak
- Increased need of blood products during outbreaks

Specific challenges during arboviruses outbreaks
- Lack of a licensed diagnostic test for arboviruses screening
- Lack of recommendations
- Low reliability of clinical blood donor screening: asymptomatic forms +++
  - DENV > 75%
  - ZIKV ?
Blood transfusion during arbovirus outbreaks in FP: global strategy

Blood products quarantine

Pathogen Inactivation (Amotosalen + UVA)

NAT (DENV, ZIKV, CHIKV)

Blood safety
Pathogen inactivation by amotosalen + UVA (Intercept) applied to arboviruses

<table>
<thead>
<tr>
<th></th>
<th>Platelet (log reduction)</th>
<th>Plasma (log reduction)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WNV</td>
<td>&gt; 6</td>
<td>&gt; 6.8</td>
</tr>
<tr>
<td>CHIKV</td>
<td>&gt; 6.4</td>
<td>&gt; 7.6</td>
</tr>
<tr>
<td>DENV</td>
<td>&gt; 5 (DENV 2,3,4)*</td>
<td>&gt; 5.7** (DENV-1)</td>
</tr>
<tr>
<td>ZIKV</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

* Dupuis, K, Arnold, D, and Sawyer, L. Transfusion 2012, 52: 225A
Validation of Intercept inactivation for ZIKV in plasma units

Validation of Intercept inactivation for ZIKV in plasma units

<table>
<thead>
<tr>
<th>Plasma samples</th>
<th>Mean viral titers ($\log_{10}$ TCID₅₀/mL)</th>
<th>Mean RNA loads ($\log_{10}$ copies/mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-inactivated</td>
<td>6.57</td>
<td>10.25</td>
</tr>
<tr>
<td>Post-inactivated</td>
<td>N</td>
<td>9.51</td>
</tr>
<tr>
<td>Post-inactivated after 1&lt;sup&gt;st&lt;/sup&gt; passage</td>
<td>N</td>
<td>3.86</td>
</tr>
<tr>
<td>Post-inactivated after 2&lt;sup&gt;nd&lt;/sup&gt; passage</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Post-inactivated after 3&lt;sup&gt;rd&lt;/sup&gt; passage</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Post-inactivated after 4&lt;sup&gt;th&lt;/sup&gt; passage</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Post-inactivated after 5&lt;sup&gt;th&lt;/sup&gt; passage</td>
<td>N</td>
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N: no virus detected by IF or no RNA detected by PCR.
### Intercept and arbovirus update

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<td>ZIKV</td>
<td>-</td>
<td>5.6 (10 log_{10} copies /ml)</td>
</tr>
</tbody>
</table>

**25th Regional congress of the ISBT, London, June 27 - July 1, 2015**

**ISBT Working Party Meeting, June 26, 2015**
Nucleic acid testing for DENV, CHIKV and ZIKV

RNA extraction

RT-PCR

- Stop

+ Unitary testing

ZIKV
- 42 positives / 1,505 blood donors (2.8 %)
- Viral loads in asymptomatic blood donors: 3.40 to 6.91 $\log_{10}$ copies/mL (mean 4.85 $\log_{10}$ copies/mL)
- Intercept inactivate $\geq 10 \log_{10}$ copies /ml +++

CHIKV
- 34 positives / 3,656 blood donors (0.9%)

DENV
- 2 positives / 6,142 blood donors (0.03%)
PI versus NAT, the French Polynesia experience

- When only 1 « emerging » or « atypical » pathogen is circulating: Including NAT in the panel of pathogen screening is possible, but it requires a center to have a molecular lab facility.

- When 2 « emerging » or « atypical » pathogens are circulating: NAT is complicated, PI is certainly the best solution.

- If more than 2 « emerging » or « atypical » pathogens are circulating: routine NAT is unreliable, PI is the only solution.
The need for remote areas +++

A pathogen inactivation system that works in the same manner for red cells + plasma + platelets
You are welcome in French Polynesia: we have more than viruses!