CHIK OUTBREAK ON REUNION ISLAND in 2005-2006

- Introduction

- General aspects
  - Reunion Island
  - Chikungunya Virus (CHIKV) infection

- Epidemic situation on Reunion Island in 2005-2006

- Estimated risk of CHIKV viremic blood donation

- Measures taken for blood products

- Adaptation of the measures after the outbreak
INTRODUCTION

CHIKV caused a massive epidemic on Reunion Island in 2005-2006 (peak in February 2006)

Risk transmission of CHIKV by blood products was a major concern.

Risk assessments need to be performed for blood products

Constitution of a Working group, coordinated by Afssaps, including :

- External experts in Virology
- Ministry of Public Health
- French Institute of Public Health Surveillance (InVS)
- French Blood Establishment (EFS)
INTRODUCTION

French agency for the safety of health products (AFSSAPS)

French Blood Establishment (EFS)

Ministry of Public Health

French Institute of public health surveillance (InVS)
Reunion Island belongs to the French Overseas Department (DOM)
Chikungunya Virus

- Alphavirus (RNA, enveloped) that belongs to the Togoviridae family
- transmitted by Aedes mosquitoes (albopictus, aegypti...)

- *Aedes albopictus* circulated during the epidemic on Reunion Island
GENERAL ASPECTS – CHIKV INFECTION

CLINICAL SYMPTOMS

• Sudden onset of fever+ severe and painful arthralgia
  May be associated with myalgia, edemas, headache...

• Evolution is usually benign (symptoms resolve within few days).
  In some cases, severe arthralgia may persist (for months or even years).

BIOLOGICAL DIAGNOSTIC

• Antibodies
  Detection by ELISA : IgM and IgG

• Genome RNA
EPIDEMIC SITUATION ON REUNION ISLAND

ON REUNION ISLAND

- First cases were identified in April 2005
  (Cases probably imported from Comoros)

- First epidemic phase between April 2005 and July 2005
  Peak in May-June 2005

- Decrease of the number of cases between July and October 2005
  Southern hemisphere winter season – decrease of circulation of Aedes

- Epidemic Peak in February 2006
  266 000 cases cumulated form April 2005 to June 2006
Note: affected zones are shaded as countries, even if only some regions of those countries showed evidence of CHIKV circulation.
In January 2006, the risk of CHIKV transmission by blood transfusion became a major concern.

Estimated risk of CHIKV viremic blood donation were performed by INVS using

Mathematic formula developed by Biggerstaff and Petersen for West Nile virus in 2002*.

\[
\text{Mean Risk} = \left( \frac{P_a \times V_a}{L} \right) + \left( P_s \times V_s \right) \times I
\]

\( P_a \) = Proportion of asymptomatic infections
\( P_s \) = Proportion of symptomatic infections
\( V_a \) = duration of viremia among asymptomatic infected individuals
\( V_s \) = duration of viremia (duration between onset of viremia and onset of symptoms) in symptomatic patients
\( L \) = Length of the outbreak period
\( I \) = Incidence of infection (including symptomatic and asymptomatic infection)

*Biggerstaff B., Petersen L. Estimated risk of West Nile Virus transmission through blood transfusion in the US, 2002, Transfusion, vol 43, 1007, August 2003
First estimates were performed in January 2006 for different phases. Few data were available regarding CHIKV infection, some hypotheses were made for:

1. **Duration of Viremia**
   - 1.5 days = duration between onset of viremia and onset of symptoms in symptomatic patients (Vs)
   - 1.5 + 6 days = duration of viremia in asymptomatic infected individuals (Va)

2. **Proportion of asymptomatic infections**
   - 70% = Maximal proportion of asymptomatic infections (High hypothesis)
   - 30% = Minimal proportion of asymptomatic infections (Low hypothesis)

**Incidence estimates derived from data collected by Surveillance Network**

Population = 757 000 inhabitants on Reunion island
In January 2006
Estimated mean risk of viremic blood donation

- Low Hypothesis: 445/100 000 [IC 95%: 440.5-449.5]
- High Hypothesis: 1793/100 000 [IC 95%: 1782-1805]

Estimated number of symptomatic cases = 25,000 cases
[data collected between 19 Dec 2005 – 22 Jan 2006 = 35 days]

Risk assessment was performed by Afssaps for blood products:
1. Medicinal blood products
2. Labile blood products prepared on Reunion Island (Platelets, Blood Red Cells)

Exclusion measures were taken for blood donors
MEASURES TAKEN FOR BLOOD PRODUCTS

SELECTION OF BLOOD DONORS

Measures taken at the peak of epidemic

On Reunion Island, selection measures were re-enforced (since May 2005) : exclusion of donors that had have clinical symptoms of CHIKV infection, during 15 days after the resolution of their symptoms.

In French metropolitan area, since February 2006, exclusion of donors that had recently traveled on Reunion Island, Seychelles and Mauritius Islands, during 21 days after their return in French metropolitan area. For travels in Comoros, Madagascar, and Mayotte Islands the exclusion measures in place regarding malaria – 4 months exclusion – covered CHIKV risk transmission.
MEDICINAL BLOOD PRODUCTS
Albumin, Immunoglobulins, Coagulation Factors...

Measures taken at the peak of epidemic

Regarding CHIKV risk transmission, the safety of medicinal blood products relies on:

- Exclusion measures for blood donors
- Efficacy of the production process towards clearance of viruses representatives for CHIKV (eg HCV or BVDV), showed by viral validation studies.

(ICH Q5A + NfG Viral validation studies)

No specific measure were taken
MEASURES TAKEN FOR BLOOD RED CELLS

RED BLOOD CELLS

Measures taken at the peak of epidemic

- Estimated risk of CHIKV viremic blood donation around 1500/100 000

- Few data on
  - consequences of a potential virus transmission by blood transfusion
  - the efficacy of donors exclusion measures
  - the duration of viremia
  - the real proportion of asymptomatic donors

Collection of whole blood donations for the preparation of Red Blood Cells was interrupted on Reunion Island.

Red Blood Cells were supplied by French metropolitan area
PLATELETS

Measures taken at the peak of epidemic

- Necessity to maintain the collection on Reunion Island
  - Supply from French metropolitan area could not be envisaged
    - Short life-
    - time of platelets (around 5 days)
    - need of fresh platelets (1-2 days) in some clinical indications

Collection of apheresis blood donations for preparation of platelets was maintained on Reunion Island. Each blood donation systematically screened by NAT for CHIKV Intercept treatment was applied.
Psoralene S-59 (Amotosalen) + UVA 320-400 nm irradiation.

Viral validation studies with CHIKV: reduction factor > 5.25 logs
Adaptation of the measures after the outbreak

Situation in 2007,
Large decrease of epidemic
Estimated number of symptomatic cases : 75
[data collected between Jan 1, 2007 and April 15, 2007]

More precise estimates of the proportion of asymptomatic infections = 15%
obtained through a sero-epidemiologic survey

Estimated risk of CHIKV viremic blood donation : <1/100 000 (0.27/100 000)

1/3 population on Reunion Island had been infected (antibodies considered as protective)

No case of CHIKV transmission by blood transfusion reported by Hemovigilance system
ADAPTATION OF THE MEASURES AFTER THE OUTBREAK

- Measures taken at the peak of epidemic were reconsidered

Collection of whole blood donations for the preparation of Red Blood Cells was re-initiated on Reunion Island (48H quarantine before distribution)

Platelets treated by Intercept (screening of blood donation by NAT not necessary)
CONCLUSION

Facing the Chikungunya Epidemic:

- Afssaps set up a Task Force
  - External experts in Virology
  - Representatives of French Institutions involved (INVS, EFS, Ministry of Public Health etc...)

- Risk assessment were performed for Health products, in particular blood products.

- Measures were taken with regards to - donors selection
  - blood products

- Measures were adapted after the outbreak

Same strategy can be applied to other emerging diseases:
  e.g. West Nile Virus