Transfusion-Transmitted Malaria in the United States: Focus on FFP

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Transfusion-Transmitted Malaria

- Background
- Epidemiology in the United States, as relevant to FFP
- Lookback at outcome of recipients of FFP from known malaria-infected donors
- Medical literature
Malaria

- Protozoan parasitic disease
- Caused by 1 of 4 species of *Plasmodium*:
  - *P. falciparum*, *P. vivax*, *P. malariae*, *P. ovale*
- Transmitted by bite of infected female anopheline mosquito
Malaria in the United States

- Eradicated in late 1940s

- Approximately 1,000 - 1,400 cases reported annually
  - Almost all imported
  - US travelers or foreigners

- Each year a few cases (<10) are transmitted within US
  - Transfusion or organ transplantation
  - Congenitally acquired
  - Local mosquito-borne transmission
Imported Malaria

- Approximately half of cases - immigrants, refugees, residents of malarious countries who come to US
- Half in US travelers - civilians and military
- Major risk factor is failure to use effective chemoprophylaxis
  - 85% of cases use no or ineffective prophylaxis
Malaria Transmission Cycle

- **Parasite undergoes sexual reproduction in the mosquito (9-35 days)**
- **Sporozoites injected into human host during blood meal**
- **Some merozoites differentiate into male or female gametocytes**
- **Exo-erythrocytic (hepatic) Cycle:** Sporozoites infect liver cells and develop into schizonts, which release merozoites into the blood (7-16 days)
- **Erythrocytic Cycle:** Merozoites infect red blood cells to form schizonts (36-72 hours)
- **Dormant liver stages (hypnozoites) of P. vivax and P. ovale**
Malaria Species

No persistent liver stage (non-relapsing)
- *P. malariae* - can persist at low levels in blood for years to decades
- *P. falciparum* - rarely persists beyond 1-2 years
  - Responsible for most deaths due to malaria

Persistent liver stage (relapsing) - rarely last beyond 3 years
- *P. vivax*
- *P. ovale*
Transfusion-Transmitted Malaria

- Rare in the US
  - Estimated incidence:
    1 case/4 million units collected

- High case fatality rate

- 3 complicated *Plasmodium falciparum* infections reported during 1996-1998
Transfusion-Transmitted Malaria in the United States, 1963-1999

- 93 reported cases

- Implicated blood component (n = 70)
  - Whole blood 63%
  - Packed RBCs 31%
  - Platelets 6%

- 67 implicated donors

- No change in incidence in last 15 years
What about “unsolved cases”? 

- Any suggestion FFP could have been the infective blood product?

- Case-patient got FFP in 10 of 92 cases where data were available
  - In 6 cases, an implicated donor was found
    - In 5 of those 6, whole blood or PRBCs
    - In 1 of those cases, implicated product not mentioned in records (patient got PRBCs, platelets and plasma)
What about “unsolved cases”?

- What about the other 4 cases?
  - 1 case – PRBCs/FFP – both RBC donors serologically neg but had traveled (unknown where); couldn’t track FFP donors
  - 1 case – PRBCs/ WB/FFP – all donors neg but 1 donor had traveled to Ghana – unknown which component he donated
  - 2 cases – incomplete investigation - couldn’t even track the whole blood donors

- **Bottom line:** no cases where evidence for transmission from other components definitively ruled out
Lookback: Recipients of FFP from Malaria-Infected Donors, 1990-2000

• 14 cases (one investigation still in progress)

• Of the 13 remaining cases:
  • No FFP transfused = 4
  • FFP transfused – no evidence subsequent malaria = 3
  • Investigation pending = 6
Evidence in the Medical Literature Related to Risk from FFP?

- Bruce-Chwatt*
  - Reports to WHO from 1911-1972
  - 2001 reported cases without mention of infection associated with FFP transfusion

Evidence in the Medical Literature Related to Risk from FFP?

• Lozner & Newhouser, 1943* - transfused plasma from patients with malaria into 35 recipients
  • No transmission from frozen (n=20) or dried (n=3) plasma
  • Liquid plasma – transmission from plasma stored 1 day (2 of 2), ? in that stored for 1 week (1 of 5), and none stored for 2 weeks (n=5)