MICROBES OR MEN: WHO WILL WIN?

Spetses
September 4, 2010
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Emerging infectious diseases of the past
The black plague
Outline

- Emerging infectious diseases of the past
- 1870-1970: A century of successful war against infectious diseases
Louis Pasteur by Edelfelt
(Pasteur museum)
A deadly disease which could be eradicated worldwide since 1977, thanks to a generalized vaccination campaign led by WHO
Outline

• Emerging infectious diseases of the past
• 1870-1970: A century of successful war against infectious diseases
• 1976: the turning point
Legionella, a bacterium from the environment that can grow in pulmonary cells
• Event N° 1: Philadelphia, Pennsylvania, USA, in July (Legionellosis)
• Event N° 2: Connecticut, USA
**Borrelia burgdorferi**
A tick bite may transmit *Borrelia burgdorferi*
A white tail deer
Cases of Lyme disease in the USA in 1998
Erythema resulting from a bite by an infected tick
• Event N° 1: Philadelphia, Pennsylvania, USA, in July (Legionellosis)
• Event N° 2: Connecticut, USA (Lyme disease)
• Event N° 3: Yambuku, Zaïre, in september
Mission at Yambuku

Professor SUREAU, a scientist from Institut Pasteur who was part of the WHO mission sent to Yambuku,
Ebola virus, a filovirus

COTE D'IVOIRE
Taï 1994

GABON
1994 Mekouka
1996 Mayibout II
1996 Booué

DRC 1977 Tandala

DRC 1976 Yambuku

GABON – CONGO 2001-4
Mékambo Oloba Kellé

SOUTH AFRICA 1996
Johannesburg

SUDAN 1976 Maedi Nzara
1979 Nzara
2004 Yambio
(17 cas 7 décès)

UGANDA
2000 Gulu

Switzerland

○ outbreak
△ Sporadic cases
◆ Imported case
Bats as reservoirs for Ebola virus
• Event N° 1: Philadelphia, Pennsylvania, USA, in July (Legionellosis)
• Event N° 2: Connecticut, USA (Lyme disease)
• Event N° 3: Yambuku, Zaïre, in September (Ebola haemorrhagic fever)
• Emerging infectious diseases of the past
• 1870-1970: A century of successful war against infectious diseases
• 1976: the turning point
• AIDS
HIV burgeoning at the cell surface
Equipes des chercheurs de l'Institut Pasteur ayant isolé et séquencé les virus du sida VIH1 et VIH2.
Carving of monkey meat at an African market: one of many opportunities for the transmission of AIDS virus to man.
Carving of monkey meat at an African market: one of many opportunities for the transmission of AIDS virus to man.
Outline

- Emerging infectious diseases of the past
- 1870-1970: A century of successful war against infectious diseases
- 1976: the turning point
- AIDS
- Emergence is often caused by mankind
Mad cow disease
Microbe adaptation: Resistance to anti-infectious agents
Antibiotic resistance by mutation or acquisition of resistance genes

- Modification of the target
- Short circuit of the target enzyme
- Alteration of membrane permeability
- Production of an enzyme destroying or modifying the antibiotic
- Efflux pumps
• Microbe adaptation: Resistance to anti-infectious agents
• Influenza: adaptation to the immune defence and crossing of the species barrier
Structure of an influenza virus
Pandemics of the 20th Century

1918 Spanish
20-50 million
H1N1

1957 Asian
1 million
H2N2

1968 Hong Kong
0.5 million
H3N2

Source: Professor Robert G Webster
Department of infectious diseases, St Jude children’s Hospital
The A (H1N1) influenza virus
• Microbe adaptation: Resistance to anti-infectious agents
• Influenza: adaptation to the immune defence and crossing of the species barrier
• Chikungunya: adaptation of a virus to an insect vector
- Alphavirus (Togaviridae)
- mosquito-borne (Aedes)
- First described outbreak: Tanzania (1952)
- Africa, India, Asia: outbreaks 1952 - 2005
- Fever, polyarthralgia, headache, myalgia
- Never detected in Indian ocean islands
Aedes albopictus
Chikungunya: the epidemic
Appearance of mutation E1-226 during 2005

- E1-226A
- E1-226V

- Mar-June 2005
- Sept.-Dec. 2005
- Jan.-March 2006

Mutation

- Faster multiplication in the mosquito
- More efficient transmission to man
- Exceptional epidemics

History of the virus
Mutation E 226 increases transmission of Chikunguya virus by
• Will the microbes win?
• Epidemiological and environmental surveillance
Epidemiological and environmental surveillance
Anomalies NDVI: sept, nov 2006
Nombre de Cas

Early Detection

Fast Response

Control Opportunity

Animal vaccine

Temps
• Epidemiological and environmental surveillance
• Towards an « intelligent » search for new anti-infectious agents
Neuraminidase and oseltamivir
• Epidemiological and environmental surveillance
• Towards an « intelligent » search for new anti-infectious agents
• Domesticating the immune system
Collection of serum from a horse
to be used for serotherapy against diphtheria or tetanos.

Stable at Institut Pasteur in Marnes-la Coquette, around 1900/1910
• Epidemiological and environmental surveillance
• Towards an « intelligent » search for new anti-infectious agents
• Domesticating the immune system
• Genes to the rescue
Genes to the rescue
• Epidemiological and environmental surveillance
• Towards an « intelligent » search for new anti-infectious agents
• Domesticating the immune system
• Genes to the rescue
• Control of the populations of arthropod vectors
• Conclusion