

# Biological peculiarities of *Y.pestis* & *H.pylori* in Kazakhstan.

Presenter: Pavel N. Deryabin

Co- authors: Atshabar B.B. , Suleimenov B.M., Nekrasova  
L.E., Begimbaev E.Zh., Koszhanov S.A.

# Background

The two most recent studies of the Kazakh Medical University and the Kazakh center of Quarantine and Zoonotic infections describe biological features of *Y.pestis* and *H. pylori*.

1. Sporadic cases of plague are observed in Kazakhstan due to the presence of the natural foci and regular monitoring of biological features of *Y. pestis* is conducted.
2. Gastric and duodenal ulcers caused by *H. pylori* is increasing and occurrence of resistant strains complicates the treatment.

# Plague - epidemiology

- 6 natural foci of plague, including 20 autonomous foci in deserts, steppes and mountain areas, that represent 40% of the territory of Kazakhstan.
- Routine surveillance, including research of biological features of strains is conducted by 10 regional antiplague stations
- During the last 10 years due to the anti-epidemic measures only sporadic case of plague (1 – 9 cases per year) are observed.

# Biological features of *Y. pestis*

- Approx. 4 000 *Y.pestis* strains were isolated during the last 10 years.
- All the strains had features typical for their subtypes and circulated among marmots, sandpipers, ground squirrels and voles.
- Range of features for the wild strains correlated with ecological dependency and phases of epizootic process.

# Activity of F1 antigen

- Approximately 5% of strains in Balkhash area were FI (−) and FI (±) with low virulence for white mice (LD50 -  $10^6$  KOE)
- Virulence in regard to the natural carriers was still high

# Auxotrophy

- Requirement in amino acids at 37 °C. with mandatory need in glutamic acid is the basic indication of strains, isolated in plague “enzootic’s nucleus”.
- *Y. pestis* carry-over from enzooty area is accompanied by decrease of requirement level in amino acids.
- Strains of *Y. pestis*, extracted from secondary carriers, vectors, ticks and white mice have lower requirement level in amino acids.
- Strains isolated in “enzootic’s nuclei” are reference-strains of current *Y. pestis* population.

# Sensitivity and resistance to antibiotics

- All the strains were sensitive to antibiotics used to treat plague when used in the following doses:
  - Streptomycin at 0.78 – 3.0 mgr/ml
  - Gentamicin at 0.78– 2,0 mgr/ml
  - Tetracyclines, chloramphenicol – less than 10 mgr/ml
  - Ciprofloxacin – less than 5 mgr/ml

# Recommendations

- The following combination were identified as optimal for treatment:
  - streptomycin and ciprofloxacin
  - streptomycin and doxycycline
  - streptomycin and chloramphenicol
  - gentamicin and ciprofloxacin
- The single dose of streptomycin should be decreased from 0.5 gr. to 0.3 gr. and the frequency of uptake increased to allow the daily dose of 2,0 gr for adults.

# Introduction H.pylori

- The first study of H. pylori infection in Kazakhstan was conducted during 2004-2007.
- Samples from 106 patients (age 17 – 73) with the following diagnoses were studied:
  - Erosive and catarrhal forms of chronic gastritis
  - Gastric ulcer
  - Duodenal ulcer

# Methodology

- 2 biopsies from each patient were obtained during examination of gastric antrum and fundus.
- Biopsies were placed into the sterile tubes and delivered to the lab within one hour.
- Material was inoculated into one of the several mediums
- Cultivated in atmosphere containing 10% CO<sub>2</sub> and 5% O<sub>2</sub> at 37°C during 11 days.

# Mediums used

- Basic - Columbia agar with 10% heparinized sheep blood
- Basic + selective H.pylori FD 090
- Basic + selective H.pylori FD 090 +elective FD 009 additives
- 4 Ready made mediums:
  - MP1553;
  - MP1554;
  - MP 1555;
  - alternative for helicobacter MP1556.

# Effectiveness of medium

| Medium Content           | Number of patients | Number of patients with HP obtained |           |
|--------------------------|--------------------|-------------------------------------|-----------|
|                          |                    | abs                                 | %         |
| Basic*                   | 7                  | 1                                   | 14,3±13,2 |
| Basic + F090**           | 7                  | 5                                   | 71,4±17,1 |
| Basic + F090**           | 46                 | 13                                  | 28±5,4    |
| Basic + F090** + F009*** | 35                 | 19                                  | 54,3±8,4  |

**Basic - Columbia agar with 10% heparinized sheep blood**

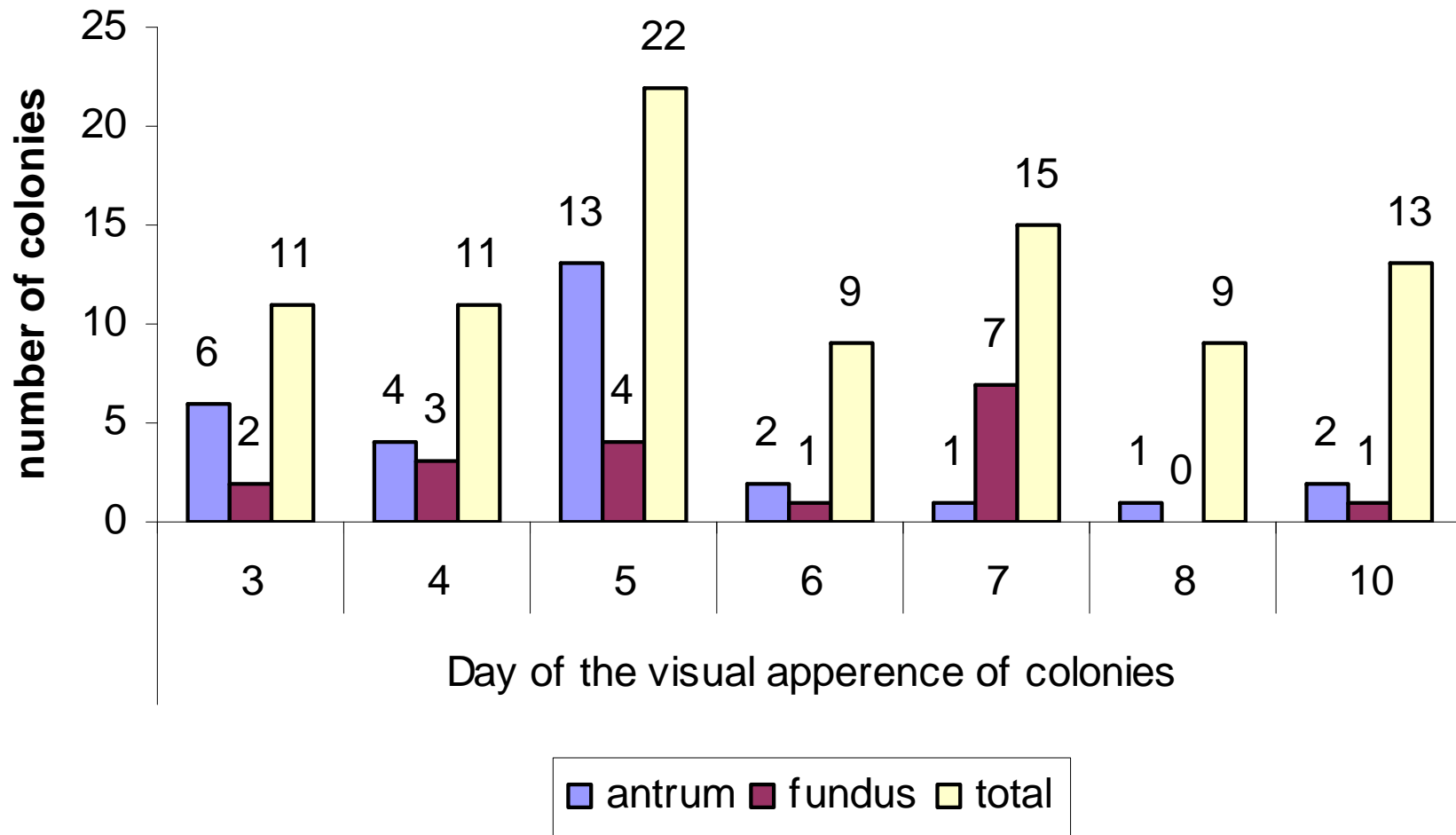
**F090 – Selective additive**

**F009 – Elective additive**

# Effectiveness of medium

| Medium                           | Number | Number of biopsies with HP obtained |          |
|----------------------------------|--------|-------------------------------------|----------|
|                                  |        | abs.                                | %        |
| <b>Basic* + F090** + F009***</b> | 25     | 15                                  | 60,0±9,8 |
| MP1553                           | 25     | 16                                  | 64,0±9,6 |
| MP1554                           | 25     | 16                                  | 64,0±9,6 |
| MP1555                           | 25     | 17                                  | 68,0±9,3 |
| MP1556                           | 25     | 10                                  | 40,0±9,8 |

# Time needed for the colonies to appear



# Biological features

- Morphological and biochemical features of all the strains were typical:
  - Colonies: small in size, round with smooth edges, translucent and soft, rarely solid growth
  - Microscopy: Gram negative, elongated rods with the rounded ends were detected
  - Biochemical features: oxidase- and catalase positive, positive urea test, positive results on H<sub>2</sub>S and were sensitive to nalidixic acid. Unable to ferment glucose, produce nitrates or form indol.

# Sensitivity and resistance

- amoxicillin,
- clarithromycin,
  - pefloxacin,
  - gentamicin,
  - ampicillin,
    - oxacillin,
    - cefazolin,
- azithromycin and
  - metronidazole.

# Sensitivity and resistance

- All the strains (100%) were highly sensitive to clarithromycin and resistant to ampicillin, oxacillin and cefazolin.
- 55% of strains were highly sensitive and 45% sensitive to pefloxacin.
- 96% of strains were sensitive and 4% resistant to gentamicin.
- 83% of strains were highly sensitive and 17% resistant to amoxicillin,
- 72% of strains were highly sensitive, 4% sensitive and 24% resistant to metronidazole.

# Recommendations

- Analysis of the sensibility range shows relatively high level of resistance to amoxicillin (17%) and metronidazole (24%) which requires changes in the schemes of treatment used for patients with this pathology.
- Use of treatment schemes that include pefloxacin and azithromycin can be considered as promising during possible trials.

# Thank you!

Questions:

[pderyabin@gmail.com](mailto:pderyabin@gmail.com)