Lessons from listeriosis outbreaks and perspectives
A need for global knowledge on *Listeria* and listeriosis

- **To better define the burden of listeriosis (sporadic cases and clusters of cases)**
  - Think about listeriosis in case of meningo-encephalitis and maternal-fetal infection
  - Train microbiologists to grow and identify *Listeria*
  - Train clinicians to diagnose and manage listeriosis
  - Notification of listeriosis cases to public health authorities

- **To identify the food sources of infection**
  - A food questionnaire taking into account the country's eating habits

A need for global knowledge on *Listeria* and listeriosis

- **Number of cases worldwide?**

- **Detailed description of listeriosis in the US and France**
  - Retrospective study, Mylonakis et al., Medicine, 1998 & 2002
  - MONALISA prospective study, Charlier et al., Lancet Infect. Dis., 2017

- **What about other continents? (South America, Africa, Asia), in particular in countries where HIV infection is highly prevalent (cf. outbreak in South Africa)**

  Multicentric Observational National Analysis of LISteriosis and *Listeria*
  Prospective study

  MONALISA
  Dec 2009
  >1200 cases
ISOLATION OF LISTERIA MONOCYTOGENES

- Food-Environment: ISO 11290 – ISO 18593
- Human isolates: Horse or sheep Blood agar 5%,
- CSF: enrichment in BHI or Nutrive broth with 0.5% glucose,
- Feces: Agar Listeria according to Ottaviani and Agosti

CONFIRMATION OF THE IDENTIFICATION OF LISTERIA MONOCYTOGENES

- At minimum Gram – Haemolysis – Rhamnose – xylose
- Or: Biochemical gallery
- Maldi-Tof Mass spectrometry
- Antibimicrobial susceptibility test: Human strains

PCR GENOSEROTYPING

MLST / Clonogrouping

GENOMIC ANALYSIS

SNPS – cgMLST -wgMLST
A need for open access to genome sequencing and typing

Listeria monocytogenes

Maximum resolution on strain discrimination

Enhanced detection of persistent or recurrent strains

Improved source identification

Earlier detection and control of outbreaks

Detection of virulence/resistance traits
ALL ALERTS SHOULD INCLUDE GENOME DEPOSIT IN A PUBLIC INTERNATIONAL DATABASE FOR INTERNATIONAL INVESTIGATIONS

WHOCC GENOME DATABASE can be queried to look for matches
Genome analysis

**cgMLST advantage:**

Excellent and sufficient resolution +
Quicker than SNPs analysis +
Less computational need to compare to a large
genome database +
possible to have a common nomenclature +
easy exchange of data (light)
Global Genome Database (BigsDB Listeria)  
(curated by WHOCC and International network of curators)

Dec 2019:
~ 40,000 isolates
~ 140 submitters  
(Public Health Center and Research Labs)

http://bigsdb.pasteur.fr/listeria
An international definition of *Lm* cluster

Isolates with ≤7 allelic differences (i.e. 99.6% cgMLST similarity): have been shown (cf graph) share an epidemiological link

Pairwise allelic differences among isolates

Nomenclature proposal for *L. monocytogenes* strains

Lineage - Sublineage – ST – CgMLST type (CT)

L2 – SL7 – ST7 – CT932
An opportunity to gain knowledge about

- Biodiversity of *L. monocytogenes* strains
- Identification of new hypervirulent clones in other regions of the world than Europe and North America

- Source of contamination
  - Mostly milk derived products
  - Meat-derived products
  - Other??

Risk assessment for fruits and vegetables, poultry products

Source: Chenal-Francisque et al., EID, 2011

Source: Maury et al., Nature Commun., 2019
A need to improve food safety / *Listeria*

- National regulations include *Lm* and *Listeria* spp. microbiological criteria in foods and plant environment

- Food inspection and recall/withdrawn

- Analytical power for *Lm* and *Listeria* spp. detection/enumeration and challenge-testing

- Ownchecks and HACCP

- Investigation of food fraud

- ‘One Health’ Approach
The strength of a one-health-based surveillance system: bidirectional and continuous

- **Food/Environment (Source)**
  - Strict control of at-risk food

- **Food notification or Alert**
  - Or signal of positive plant environment

- **Inter-Minister unit for *Listeria***

- **Mandatory notification**

- **Patient (Target)**
  - Exhaustiveness

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**WHO/INFOSAN** | 09 Dec. 2019 | Alexandre Leclercq |
GOAL: WORK TOGETHER on *Listeria* and Listeriosis

- Help in the identification of *Listeria monocytogenes* in clinical and food samples
- Help in the management of sporadic cases and clusters of listeriosis
- Help in the identification of food sources
  - Help to analyse the data confidentially
  - Help in genome sequencing, technical assistance for sequencing, training
  - Help in genome analysis
  - Help in building/refining surveillance system
- Help in the characterization of *Listeria* strains
  - Phenotypically
  - At genomic level
  - Assessing virulence
  - Study of atypical antimicrobial resistance
- Study the biodiversity of *Listeria monocytogenes* at world level and identify putative new hypervirulent clones and their food sources

Source: NICD, South Africa
Challenges

Majority of investigations rely on known at-risk products

WGS coupled with rigorous sampling in food/environment and identification of human cases - In Western countries - Globally

Information extracted from WGS will contribute to better control *Lm* at a global level and reduce the risk of infections
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