

Cluster of invasive *Neisseria meningitidis* infections on a cruise ship, Italy, October 2012

P Stefanelli (paola.stefanelli@iss.it)¹, C Fazio^{1,2}, A Neri^{1,2}, P Isola³, S Sani⁴, P Marelli³, C Martinelli³, P Mastrantonio¹, M G Pompa⁵

1. Department of Infectious, Parasitic and Immune-mediated Diseases, Istituto Superiore di Sanità (ISS), Rome, Italy

2. These authors contributed equally to this work

3. Clinical Pathology Department, Azienda USL 6, Livorno, Italy

4. Infectious Diseases Unit, Azienda USL 6, Livorno, Italy

5. Communicable Disease and International Prophylaxis Unit, Directorate General of Prevention, Ministry of Health, Rome, Italy

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We describe a cluster of four cases of invasive meningococcal disease that occurred on a cruise ship sailing along the Italian coast in October 2012. All four cases were hospitalised with severe illness and one of them died. This report illustrates the importance of rapid implementation of emergency control measures such as administration of prophylaxis to all crew members and passengers to prevent the spread of the disease in such a close environment.

We report a cluster of four cases of meningitis due to infection with serogroup C *Neisseria meningitidis* ST-11 clonal complex (cc) that occurred on a cruise ship sailing along the Italian coast in October 2012. Meningococcal serogroup C strains, (ST-11 cc) are known to cause invasive disease burden worldwide [1,2]. It is also known that these hyperinvasive strains are responsible for a high mortality rate among cases [3,4]. These strains caused several outbreaks in France between 2001 and 2003 that led to targeted vaccination campaigns [5,6].

In Italy, serogroup C is the second most common serogroup (16% of the 118 cases with a known serogroup in 2011 were caused by serogroup C infection) after the serogroup B (64% of the 118 cases with a known serogroup in 2011 were caused by serogroup B infection) [7]. Meningococci C ST-11 cc have been identified in Italy during the last five years and those characterised as C:P1.5-1,10-8:F3-6:ST-11, were responsible for both sporadic and outbreak-associated cases [8].

Cluster description

In early October 2012, four staff members of a cruise ship sailing on the Italian coast were hospitalised on the same day in a local hospital in Tuscany, with clinically suspected meningitis. The four cases were aged between 26 and 47 years and originated from three different countries and three continents. They were all crew members working in the kitchen. One of these four hospitalised patients died; no secondary cases have been reported among other persons present on the ship or among other contacts of the four cases,

during the follow-up. Health authorities conducted interviews to determine the travel history of the cases and Naples was established as the last stop before the onset of symptoms. No common source of contamination could be identified during the investigations.

Laboratory investigation

One day after hospitalisation, the cerebrospinal fluid (CSF) of the four patients was examined by direct microscopy observation at the microbiology laboratory of the Livorno Hospital and the diagnosis of bacterial meningitis was established. Furthermore, on the same day, latex test and culture were performed in the same hospital, whereas serogroup C meningococci were confirmed by rapid molecular test at the Laboratory of the Paediatric Department, Meyer Hospital, University of Florence. The four *N. meningitidis* isolates identified, were sent to the National Reference Laboratory for Invasive Meningococcal Diseases of the Istituto Superiore di Sanità for serogroup confirmation, antimicrobials susceptibility and molecular typing characterisation.

In particular, multilocus sequence typing (MLST) [9] and sequencing of outer membrane proteins PorA and FetA were performed to define the clonal complex and the finetype, respectively; *porB* gene was also analysed. Variable number tandem repeats (VNTR) typing, using standardised procedures [10], was also carried out to further discriminate among strains. Sequence analysis of *penA* gene was used to determine the corresponding allele defining isolates with a decreased susceptibility to penicillin [11].

The molecular investigations showed that all strains were C:P1.5-1,10-8:F3-6:ST-11. The discriminatory power of MLST and antigen sequence typing highlighted that the four isolates clearly belonged to ST-11 cc, finetype P1.5-1, 10-8:F3-6. The *porB* allele was 2-2 for all of them. The VNTR analysis (data not shown) confirmed the presence of a unique profile among the four

strains which was different from all the others found in ST-11 cc isolates circulating in Italy [12].

The antibiotic susceptibility assay showed a full susceptibility to rifampicin, ciprofloxacin, ceftriaxone and a decreased susceptibility to penicillin and ampicillin. The analysis of *penA* gene showed the presence of the same allele (248), often associated with a decreased susceptibility to penicillin ($0.06 < \text{MIC} \leq 1$ mg/L) [13].

Control measures

On the hospital admission day of the four cases described above an alert was launched from the Maritime Port Health Offices of Livorno to the Ministry of Health which ensured rapid communication of this cluster to national and international health authorities for achieving a coordinated response and proper management of this public health event.

On the same day, as an emergency control measure, it was decided to administer chemoprophylaxis with ciprofloxacin to about 2,000 persons present on the ship (international passengers and crew members) before some people left.

In general, the management of meningococcal disease cases focuses on early recognition and antibiotic treatment to reduce case fatality rate and to control the spread of the disease. In the cluster described above, the prompt prophylaxis to all crew members and passengers, as an emergency control measure in such a close environment as a ship, ensured the meningococcal spread control. The rapid strain typing was essential to assess the link among isolates and to highlight the circulation of hyper-invasive ST-11 meningococci.

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