Cephalosporin-resistant *Neisseria gonorrhoeae* is a major public health concern. *N. gonorrhoeae* of multiantigen sequence type G1407 and multilocus sequence type 1901 is an internationally spreading cephalosporin-resistant clone. We detected 4 cases of infection with this clone in China and analyzed resistance determinants by using *N. gonorrhoeae* sequence typing for antimicrobial resistance.

Gonorrhea, the second most prevalent sexually transmitted infection (STI) globally, remains a major public health concern in China. From 2015 to 2016, the reported cases of gonorrhea in China increased by 14.7% (100,245 to 115,024) (7). The extended-spectrum cephalosporin ceftaxime has been recommended as monotherapy to treat gonorrhea in China since 2007 (2), but resistance to this drug emerged almost at the same time (3). Presently, the transmission of internationally spread cephalosporin-resistant clones in China has become a threat to effectively controlling gonorrhea (4). Strains with *N. gonorrhoeae* multiantigen sequence type (NG-MAST) G1407 and multilocus sequence type (MLST) 1901 have been successful clones associated with cephalosporin resistance and have caused clinical treatment failures in France and Spain (5,6); these strains have also become the predominant clones in the United Kingdom (7) and Japan (8) and among US men who have sex with men (9). Here we report 4 cephalosporin-resistant NG-MAST G1407/MLST 1901 clones identified out of 2,038 isolates collected through China’s Gonococcal Resistance Surveillance Program during 2015–2016.

Demographic and clinical information for the 4 case-patients are summarized in online Technical Appendix Table 1 (https://wwwnc.cdc.gov/EID/article/24/4/17-1817-Techap1.xlsx). All case-patients were adult men; gonococcal isolates were obtained from urethral swab samples. The 4 men had obvious urethral discharge and were diagnosed with acute urethritis. Gram staining and culture of the urethral swabs were positive for gonococcal infection. One of the 4 patients self-reported being a man who has sex with men. One of the infections, occurring in Zhejiang Province, was treated with a single-dose regimen of spectinomycin (4 g); the other 3 infections, occurring in the municipality of Chongqing, were treated with a 2-dose regimen of ceftriaxone (1 g) administered over 2 days. Test-of-cure follow-ups were not performed.

All strains were transferred to the reference laboratory at the National Center for Sexually Transmitted Disease Control, Chinese Center for Disease Control and Prevention. Gram staining, a rapid oxidase reaction test, and a carbohydrate utilization test confirmed the identification of *N. gonorrhoeae*. We determined antimicrobial susceptibility to ceftriaxone (CRO), cefixime (CFM), spectinomycin (SPT), azithromycin (AZM), ciprofloxacin (CIP), and
penicillin (PEN) by using the agar dilution method. We detected β-lactamase (penicillinas)-producing *Neisseria gonorrhoeae* isolates by using a nitrocefin solution filter paper test. These strains were resistant to CRO, CFM, PEN, and CIP but susceptible to AZM and SPT based on susceptibility and resistance breakpoints from the European Committee on Antimicrobial Susceptibility Testing (http://www.ecucast.org/clinical_breakpoints) (Table). MICs of ceftriaxone ranged from 0.25 to 0.50 mg/L, and MICs of cefixime ranged from 0.5 to 1.0 mg/L.

We performed NG-MAST and MLST genotyping to identify the sequence types (10). MLST showed all 4 strains to be type 1901, and NG-MAST showed the Zhejiang strain to be sequence type (ST) 10332 and the Chongqing strains to be ST1407. ST10332 has a 2-basepair difference in the *porB* (parB6067) gene from that of ST1407 (porB908) and belongs to genogroup G1407. We used *N. gonorrhoeae* sequence typing for antimicrobial resistance (NG-STAR) to identify the characteristics of resistance determinants (11). NG-STAR showed 2 of the Chongqing strains to be ST90; the third Chongqing strain was ST194. The strain isolated in Zhejiang was ST507. All 4 strains had type XXYIV mosaic *penA* (*penA* 34,001), −35A Del in the *mtrR* promoter (*mtrR1*), G120K-A121N/D in *PorB* (*PorB/B1*), L421P in *PonA* (*PonA1*), S91F-D95A/G in *GyrA* (*GyrA1/7*), S87R in *ParC* (*ParC3*), and wild-type 23srRNA (23 srRNA0) (online Technical Appendix Table 2).

We conclude that the internationally reported cephalosporin-resistant NG-MAST G1407/MLST 1901 *N. gonorrhoeae* clone has spread into China. Genotyping and resistance determinants analysis showed similarity to the predominant G1407/MLST 1901 clone reported in other regions (7–9), indicating that importation into and transmission within China has occurred. Our findings suggest that increased monitoring of this clone by China’s Gonococcal Resistance Surveillance Program will be vital for monitoring trends in antimicrobial resistance.

Acknowledgments

We are grateful to the members of China’s Gonococcal Resistance Surveillance Program for providing the isolates and making this study possible. We thank William Shafer for his valuable comments.

The study was supported by grants from the Chinese Academy of Medical Sciences Initiative for Innovative Medicine (2016-I2M-3-021) and the Jiangsu Natural Science Foundation (BK20171133).

About the Author

Dr. S.-C. Chen received his PhD in microbiology and is an associate professor at the National Center for STD Control, Chinese Center for Disease Control and Prevention. His primary research interests include molecular epidemiology and the antimicrobial resistance mechanism of *N. gonorrhoeae*.

References

1. Chinese Center for Disease Control and Prevention. Epidemic of infectious diseases in China, 2016 [2018 Jan 12]. http://www.nhfpc.gov.cn/jkj/s3578/20170233ca59908a54dd9ca6308f3c406157.shtml
2. Wang QQ, Zhang GC. Guidelines for diagnosis and treatment of sexually transmitted diseases [in Chinese]. Shanghai: Shanghai Science and Technology Press; 2007.
3. Chen SC, Yin YP, Dai XQ, Unemo M, Chen XS. Antimicrobial resistance, genetic resistance determinants for ceftriaxone and molecular epidemiology of *Neisseria gonorrhoeae* isolates in Nanjing, China. J Antimicrob Chemother. 2014;69:2959–65. http://dx.doi.org/10.1093/jac/dku245
4. Chen SC, Yin YP, Dai XQ, Unemo M, Chen XS. First nationwide study regarding ceftriaxone resistance and molecular epidemiology of *Neisseria gonorrhoeae* in China. J Antimicrob Chemother. 2016;71:92–9. http://dx.doi.org/10.1093/jac/dkv321
5. Unemo M, Golparian D, Nicholas R, Ohnishi M, Gallay A, Sednaoui P. High-level cefixime- and ceftriaxone-resistant *Neisseria gonorrhoeae* in France: novel *penA* mosaic allele in a successful international clone causes treatment failure. Antimicrob Agents Chemother. 2012;56:1273–80. http://dx.doi.org/10.1128/AAC.05760-11
6. Câmara J, Serra J, Ayats J, Bastida T, Carnicer-Pont D, Andreu A, et al. Molecular characterization of two high-level ceftriaxone-resistant *Neisseria gonorrhoeae* isolates detected in Catalonia, Spain. J Antimicrob Chemother. 2012;67:1858–60. http://dx.doi.org/10.1093/jac/dks162
7. Ison CA, Town K, Obi C, Chisholm S, Hughes G, Livermore DM, et al.; GRASP collaborative group. Decreased susceptibility to cephalosporins among gonococci: data from the Gonococcal Resistance to Antimicrobials Surveillance Programme (GRASP) in England and Wales, 2007–2011. Lancet Infect Dis. 2013;13:762–8. http://dx.doi.org/10.1016/S1473-3099(13)70143-9
8. Shimuta K, Watanabe Y, Nakayama S, Morita-Ishihara T, Kuroki T, Unemo M, et al. Emergence and evolution of internationally disseminated cephalosporin-resistant *Neisseria gonorrhoeae* clones from 1995 to 2005 in Japan. BMC Infect Dis. 2015;15:378. http://dx.doi.org/10.1186/s12879-015-1110-x

---

**Table.** MICs of antimicrobial drugs for *Neisseria gonorrhoeae* isolates from 4 case-patients with cephalosporin-resistant NG-MAST G1407/MLST 1901 infections identified through the national Gonococcal Resistance Surveillance Program, China, 2015–2016*

| Case-patient no. | CRO       | CFM       | CIP       | PEN       | SPT       | AZM       | PPNG      |
|-----------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 1               | 0.5/R     | 0.5/R     | 8/R       | 16/R      | 16/S      | 1/S       | No        |
| 2               | 0.5/R     | 1/R       | 32/R      | 16/R      | 32/S      | 0.5/S     | No        |
| 3               | 0.5/R     | 0.5/R     | 32/R      | 16/R      | 32/S      | 1/S       | No        |
| 4               | 0.25/R    | 0.5/R     | 64/S      | 16/R      | 64/S      | 1/S       | No        |

*AZM, azithromycin; CFM, cefixime; CIP, ciprofloxacin; CRO, ceftriaxone; MLST, multilocus sequence type; NG-MAST, *N. gonorrhoeae* multiantigen sequence type; PEN, penicillin; PPNG, penicillinase-producing *N. gonorrhoeae*; R, resistant; S, susceptible; SPT, spectinomycin.
Lymphogranuloma venereum (LGV) is a sexually transmitted infection caused by serovars L1, L2, and L3 of the bacterium *Chlamydia trachomatis*. The infection typically causes genital ulcers, proctitis, or femoral/inguinal lymphadenopathy with or without constitutional symptoms. In the past decade, outbreaks of LGV have been reported in North America, Australia, and Europe, mainly as proctitis among HIV-infected men who have sex with men (MSM) (1). We report a patient with pharyngitis, proctitis, and cervical lymphadenitis in whom LGV-specific DNA was detected by real-time reverse transcription PCR (RT-PCR) in a cervical lymph node fine-needle aspirate.

The patient was a 48-year-old, HIV-positive man in Croatia who came to an outpatient HIV clinic in August 2014 with perianal pain for 10 days and bloody rectal discharge with normal stool consistency. He also reported a painful, enlarged cervical lymph node but did not have a sore throat. On the first day of the illness, he had fever, which subsided the next day. He reported having unprotected receptive anal and oral sex with other men while visiting Berlin, Germany, 2 weeks earlier. Clinical examination demonstrated exudate on the right tonsil, a painful and enlarged right cervical lymph node (5 × 2 cm) (online Technical Appendix Figure, https://wwwnc.cdc.gov/EID/article/24/4/17-1872-Techapp1.pdf), perianal pain on palpation, and a purulent rectal discharge.

The patient was given a diagnosis of HIV infection in 2002 and had been receiving antiretroviral therapy since July 2002. Plasma viremia had been undetectable since October 2002, and his CD4+ T-cell count before this illness was 2,082 cells/mm³. His clinical history included treatment for neurosyphilis, epilepsy, and diarrhea caused by *Microsporidia spp.*, *Blastocystis hominis*, and *Entamoeba histolytica*.

During examination at the HIV clinic, specimens were obtained from the pharynx, rectum, and urine for culture and a nucleic acid amplification test (NAAT). During fine-needle aspiration of a cervical lymph node, ≈1 mL of pus was removed and analyzed. The lymph node aspirate and a rectal swab specimen were positive for *C. trachomatis* DNA by the *C. trachomatis/Neisseria gonorrhoeae* RT-PCR (Abbott Laboratories, Abbott Park, IL, USA).

Cytologic examination of the fine-needle aspirate of the affected lymph node predominantly showed elements of granulomatous inflammation. An indirect immunofluorescence assay serum test result for *C. trachomatis* antibodies was positive (IgG titer >1:512, IgA titer 1:256). Test results for *N. gonorrhoeae* were negative (culture of the rectal swab and NAAT for urine and rectum). Results of a throat culture for *Streptococcus pyogenes* and routine lymph node aspirate culture for bacteria were also negative. Serum serologic test results were negative for acute infection with *Treponema pallidum*, *Bartonella* spp., and *Toxoplasma gondii*.

Chlamydia trachomatis in Cervical Lymph Node of Man with Lymphogranuloma Venereum, Croatia, 2014

Branimir Gjurašin, Snježana Židovec Lepej, Michelle J. Cole, Rachel Pitt, Josip Begovac

Address for correspondence: Yue-Ping Yin, National Center for STD Control, Chinese CDC, Institute of Dermatology, Chinese Academy of Medical Sciences and Peking Union Medical College. 12 Jiangwangmiao St, Nanjing 210042, China; email: yinyp@ncstdlc.org

# References

9. Grad YH, Kirkcaldy RD, Trees D, Dordel J, Harris SR, Goldstein E, et al. Genomic epidemiology of *Neisseria gonorrhoeae* with reduced susceptibility to cefixime in the USA: a retrospective observational study. *Lancet Infect Dis*. 2014;14:220–6. http://dx.doi.org/10.1016/S1473-3099(13)70693-5
10. Martin IM, Ison CA, Aanensen DM, Fenton KA, Spratt BG. Rapid sequence-based identification of gonococcal transmission clusters in a large metropolitan area. *J Infect Dis*. 2004;189:1497–505. http://dx.doi.org/10.1086/383047
11. Demczuk W, Sidhu S, Unemo M, Whiley DM, Allen VG, Dillon JR, et al. *Neisseria gonorrhoeae* sequence typing for antimicrobial resistance, a novel antimicrobial resistance multilocus typing scheme for tracking global dissemination of *N. gonorrhoeae* strains. *J Clin Microbiol*. 2017;55:1454–68. http://dx.doi.org/10.1128/JCM.00100-17

DOI: https://doi.org/10.3201/eid2404.171872

We report an HIV-infected person who was treated for lymphogranuloma venereum cervical lymphadenopathy and proctitis in Croatia in 2014. Infection with a variant L2b genotype of *Chlamydia trachomatis* was detected in a cervical lymph node aspirate. A prolonged course of doxycycline was required to cure the infection.

---

**Chlamydia trachomatis** in Cervical Lymph Node of Man with Lymphogranuloma Venereum, Croatia, 2014

Branimir Gjurašin, Snježana Židovec Lepej, Michelle J. Cole, Rachel Pitt, Josip Begovac

Author affiliations: University Hospital for Infectious Diseases Dr. Fran Mihaljević, Zagreb, Croatia (B. Gjurašin, S.Ž. Lepej, J. Begovac); Public Health England, London, UK (M.J. Cole, R. Pitt); University of Zagreb School of Medicine, Zagreb (J. Begovac)

DOI: https://doi.org/10.3201/eid2404.171872

We report an HIV-infected person who was treated for lymphogranuloma venereum cervical lymphadenopathy and proctitis in Croatia in 2014. Infection with a variant L2b genotype of *Chlamydia trachomatis* was detected in a cervical lymph node aspirate. A prolonged course of doxycycline was required to cure the infection.

---

1Results from this study were presented as a poster at the IDWEEK 2017 Conference, October 4–8, 2017, San Diego, CA, USA. Abstracts of the IDWEEK 2017 Conference have been published in a supplement issue of Open Forum Infectious Diseases (https://idsa.confex.com/idsa/2017/webprogram/POSTER.html).