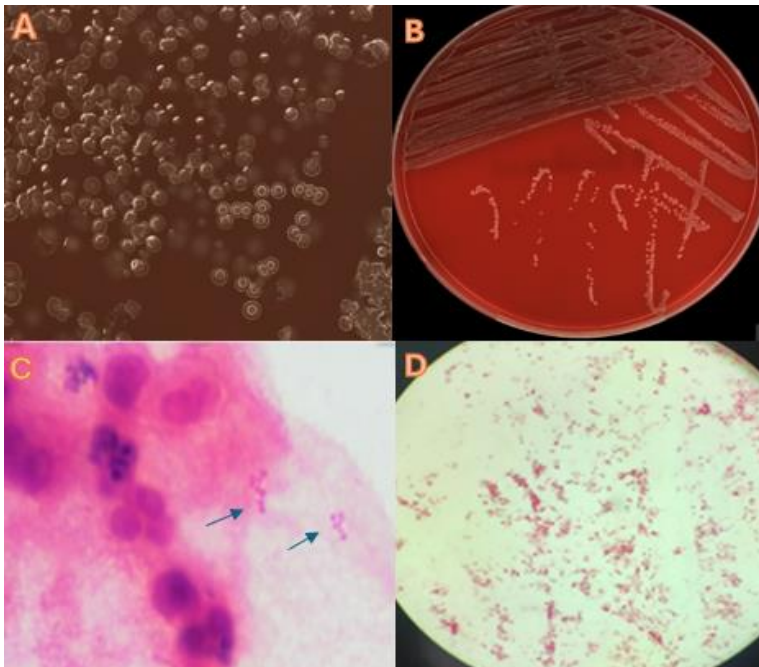


## What a pain in the neck!: An Infected Branchial Cleft Cyst

A young male with a history of a recurrent left branchial cleft cyst presented to the Pediatric Emergency Department with a two-day history of worsening left-sided facial swelling. The cyst was first identified five months prior to the current encounter as a left submandibular abscess seen on CT. He underwent bedside incision and drainage concomitantly receiving an inpatient course of IV ampicillin/sulbactam and trimethoprim/sulfamethoxazole. He was ultimately discharged home on PO amoxicillin/clavulanate. The cyst decreased in size but was never fully resolved, then gradually enlarged over the next month, and became painful to the touch. A computed tomography (CT) scan was scheduled for visualization, but a day before the imaging appointment it was noted the cyst doubled in size, resulting in the patient presenting to clinic.

The CT revealed a fluid-filled collection (approximately 3 x 2 x 3 cm) consistent with previous imaging. The patient was afebrile despite an elevated white blood cell count, and no erythema or fluctuance was observed. A second incision and drainage was performed yielding 3mL of purulent material which was submitted to the clinical microbiology laboratory for culture. The patient's symptoms improved following the procedure, and he was admitted to pediatrics for monitoring. He received IV ampicillin/sulbactam, ultimately transitioned to PO amoxicillin/clavulanate at discharge.

Gram stain of purulent samples showed heavy polymorphonuclear leukocytes and heavy Gram-negative bacilli. After one day, culture yielded heavy, pure growth on chocolate agar with grey colonies. Organisms in the culture were definitively identified by MALDITOF-TOF as *Neisseria lactamica*.



Representative images of culture plates and colony growth of *N. lactamica*. A) colony morphology on chocolate agar cultured directly from clinical material in this case. B) Colony morphology on blood agar. C) Representative Gram stain revealing Gram-negative coccoid forms representative of *Neisseria* sp. (oil immersion, 100x magnification). D) Low power view of inflammatory infiltrate expressed from the branchial cyst and submitted from culture (10X magnification).

Which of the following review questions about *Neisseria lactamica* is false?

- A. *Neisseria lactamica* is a common commensal organism found in the nasopharynx of children.
- B. *Neisseria lactamica* is oxidase and catalase positive and ferments glucose and lactose.
- C. *Neisseria lactamica* in the pharynx increases the likelihood of *Neisseria meningitidis* colonization.
- D. Transmission of *Neisseria lactamica* mainly occurs through respiratory droplets.

Answer: C.

Colonization of the pharynx by the commensal bacterium *Neisseria lactamica* **does not** increase the likelihood of *Neisseria meningitidis* colonization. Unlike *N. meningitidis*, *N. lactamica* lacks both a capsule and the outer membrane protein PorA. Despite these differences, it shares significant antigenic similarities with *N. meningitidis* helping carriers develop cross-protective antibody responses against *N. meningitidis*. As a result, colonization by *N. lactamica* during childhood provides an immunological barrier against *N. meningitidis* colonization.

Discussion:

The genus *Neisseria* was named after Albert Neisser who initially identified the etiologic agent of gonorrhea in 1879. Within the genus, two species comprise the most clinically significant pathogens: *Neisseria gonorrhoeae* (an obligate human pathogen) and *N. meningitidis*. Other species, such as *N. sicca*, *N. lactamica*, *N. subflava*, *N. flavescens*, *N. mucosa*, *N. cinerea*, *N. polysacchrae*, and *N. elongata*, are typically human commensals which colonize mucosal surfaces but rarely cause disease in immunocompetent hosts. Currently, greater than 40 unique *Neisseria* sp. are recognized.

*N. lactamica* is a non-pathogenic *Neisseria* species, typically found colonizing the upper respiratory tract of infants and children. Carriage incidence ranges from 0.4-17.3%, with reports highlighting young children with a higher carriage rate than adults. Unlike *N. meningitidis*, colonization of the oropharynx by *N. lactamica* may occur as early as two weeks after birth. The rate of colonization decreases with age, and *N. lactamica* carriage increases during winter and spring months when respiratory infections are more common. Occasional cases of meningitis and septicemia caused by *N. lactamica* have been reported but this is usually in the setting of immunocompromise or other underlying condition. While empiric management of infection caused by commensal *Neisseria* sp. often utilizes beta-lactams, it is interesting to note that *N. lactamica* can exhibit elevated MICs to penicillin.

From a microbiological standpoint, *N. lactamica* can be mistaken for *Neisseria meningitidis* due to their morphological similarities and ability to grow on selective media. However, *N. lactamica* is distinguished by its ability to acidify lactose in addition to glucose and maltose in classical CTA sugar assays, and by a positive beta-galactosidase reaction. The prevalence of *N. lactamica* may be influenced by concurrent circulation of *N. meningitidis*, as both organisms occupy similar ecologic and anatomical niches and may exchange genetic material. Evidence indicates that *N. lactamica* colonization can reduce susceptibility to *N. meningitidis* through mechanisms such as crossimmunity or competitive inhibition of adhesion. Because *N. lactamica* shares key surface structures with *N. meningitidis* (outer membrane proteins (OMPs) and lipooligosaccharides (LOS)), it can induce cross-reactive antibodies that boost bactericidal and mucosal immunity, reducing meningococcal colonization. This may help explain why children, who often carry *N. lactamica*, have lower risk of invasive meningococcal disease than adolescents.

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