Neisseria Mucosa: A New Urinary Tract Pathogen?

Daniël F. Osses a, Anneke C. Dijkmans b, Alfred H. van Meurs c, Frank M. Froeling a

a Department of Urology; b Department of Medical Microbiology; c Department of Pediatrics, Haga Teaching Hospital, The Hague, The Netherlands

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Abstract
The most common complication of vesicoureteral reflux is urinary tract infection. We report a case of a urinary tract infection in a child with severe vesicoureteral reflux, caused by Neisseria mucosa, usually considered to be a commensal inhabitant of the oro- or nasopharynx.

Introduction
Vesicoureteral reflux (VUR) is the abnormal flow of urine from the bladder to the upper urinary tract. VUR is more common in infants and young children. About 10% of children have VUR [1]. VUR is usually classified as Grade I through V, with Grade I being mild and Grade V being the most severe. In many cases a child with VUR has no symptoms, but if present, the most common complication is urinary tract infection (UTI). The most common test used to diagnose VUR is a voiding cystourethrogram (VCUG). The standard treatment for VUR has included prompt treatment of UTIs and long-term use of antibiotics to prevent UTIs until VUR diminishes spontaneously. Surgery has also been used in certain cases [2].

Neisseria mucosa (N. mucosa), a Gram-negative diplococcus, is part of the normal nasopharyngeal flora and described in the literature only as a cause of endocarditis and bacteremia in immunocompromised patients [3–5]. As far as we know, N. mucosa was never described as a pathogen for the urinary tract and not as a pathogen in immunocompetents at all.

Case Report
An 1-year-old boy was admitted with a pyelonephritis to our pediatric hospital (Juliana Kinderziekenhuis, The Hague). The antenatal ultrasound might have shown a hydronephrosis. He was treated with daily intravenous cefuroxime 800 mg for 3 days. An abdominal ultrasound revealed a severe hydroureteronephrosis and hydronephrosis on the left side, suggesting VUR. A VCUG showed a VUR Grade 5 on the left side and a VUR Grade 2–3 on the right side (fig. 1 and 2). A urine culture did not show growth of bacteria. After recovery of this first UTI-episode the boy was treated with daily trimethoprim 13 mg as an antimicrobial prophylaxis.

During a next hospitalization a cystoscopy did not show posterior urethral valves. A vesicostomy was performed to decrease reflux and prevent further harm to the kidneys. Ultrasound investigation after 6 months did not show any decrease of the hydronephrosis of the left kidney.

Seven months after performing the vesicostomy, he was again admitted with a clinical picture of occasional fever, mild complaints of UTI, cloudy odorous urine, leukocyturia and elevated CRP 47 mg/l. A pyelonephritis of the left side with a lot of debris in the kidney was diagnosed. A bladder catheter was inserted in his vesicostomy and a urine culture was obtained. This showed an isolated growth of N. mucosa (Bruker MALDI-TOF) with over
100,000 colony forming units/ml which was treated based on the sensitivity first with daily intravenous cefuroxime 1,150 mg for 4 days and later co-amoxiclav per os 575/144 mg daily for 10 days. Because of this breakthrough infection despite antimicrobial prophylaxis he is scheduled for a ureteral reimplantation on the left side.

**Discussion**

Apart from *N. meningitidis* and *N. gonorrhoeae*, which are primary pathogens, all other *Neisseria* species are considered to be commensal inhabitants of the mucosae of humans or animals. Although these bacteria are regarded as having low pathogenicity, *N. mucosa* has been reported before to cause serious infections such as endocarditis and now in our case-report a complicated urinary tract infection.

*N. mucosa* is non-motile, non-acid fast, non-spore-forming bacteria and resembles a coffee bean when viewed microscopically. It grows optimally at temperatures ranging 35–37 °C, and growth is usually stimulated by CO₂ and humidity [6]. These are conditions occurring in the urinary tract. *N. mucosa* may be transmitted by contact with droplets and discharges from the nose and throat of infected persons. The infection however is rare due to low virulence [7, 8]. During hospitalization of our patient, his parents told us that the four family members had an upper respiratory tract infection. In theory they could sneeze and cough the bacteria into the vesicostomy of our patient or he could do this by himself.

The exact pathogenesis of *N. mucosa* is unknown. It is known that it has some similarities with that of *N. meningitidis* and *N. gonorrhoeae*. For example: *N. mucosa* has also the ability to invade and replicate within neutrophils, as well avoiding phagocytosis and being killed by complement by resisting opsonization by antibodies, which target the pathogen for destruction. Furthermore *N. mucosa* contains porins which are an important factor for complement inhibition. The ability to translocate into host cells and modulate reactive oxygen species production and apoptosis is also made possible by porins [7].

All the described infections caused by normally commensal *N. species* were in individuals with underlying medical conditions and/or immune suppression or deficiency. Our patient has a vesicostomy, which can be considered as an easy porte d’entrée for bacteria. Having a VUR Grade 5 on the left side, he is at risk for opportunistic infections. When our patient was admitted to the hos-

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*Neisseria Mucosa*, a Urinary Tract Pathogen

**Fig. 1.** An abdominal ultrasound showing a severe hydronephrosis of the left kidney.

**Fig. 2.** A voiding cystourethrogram showing a vesicoureteral reflux Grade 5 on the left side and a vesicoureteral reflux Grade 2–3 on the right side.
hospital a bladder catheter was inserted in his vesicostomy, and during several episodes (maximum 6 weeks) as an outpatient a catheter was situated in his vesicostomy. In theory *N. mucosa* could have colonized on the catheter. However, it is unknown if *N. mucosa* survives on plastic.

Since a significant amount of leucocytes in the urine were seen and we had an axenic culture with this microorganism, *N. mucosa* is very likely to be the urinary tract pathogen in this case. This is underwritten, since the UTI resolved by the antimicrobial therapy.

Relatively little attention has been paid to other *Neisseria* species than *N. meningitidis* and *N. gonorrhoeae*, as they have generally been regarded as harmless organisms of little clinical importance. While it is true to say that *N. mucosa* does not rank among the major pathogens encountered in the field of infectious diseases, it looks that it may cause infections more frequently than is usually appreciated. Microbiologists should be cautious in dismissing *N. mucosa* too readily as part of non-pathogen flora, when it is isolated from clinical material [8].

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