Epidemiology of the Reemergence of Gonorrhea in Sweden

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Background: **After many years of decline, the incidence of gonorrhea in Sweden reached an all-time low of 2.4 cases per 100,000 inhabitants in 1996; however, the incidence has been increasing since 1997.**

Goal: **To describe the reemergence of gonorrhea in Sweden using clinical epidemiologic data and microbiologic characterization of isolated strains of *Neisseria gonorrhoeae*.**

Study Design: ***N gonorrhoeae*** **strains isolated in Sweden from February 1998 to January 1999 were serotyped and an epidemiologic data questionnaire was sent to each clinician reporting a case of gonorrhea.**

Results: **Epidemiologic and microbiologic data were obtained for 357 cases (91% of all cases diagnosed during the period). Domestic cases had significantly increased since 1997. Serovar IB-3 was the most common isolate in domestic cases of heterosexually exposed teenagers, and serovar IB-2 was the most frequent isolate in domestic cases of homosexually exposed men. Of the imported cases, 47% were exposed in Asia and 6.5% were exposed in Eastern Europe.**

Conclusion: **The increase of gonorrhea in Sweden is due to an increase of domestic cases. Heterosexual teenagers and homosexual men were identified as core groups infected by different serovars of *N gonorrhoeae*.**

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SEXUALLY TRANSMITTED DISEASES (STDs) remain a major public health problem worldwide.[1] In Sweden, fairly reliable statistics regarding gonorrhea have been available since 1912 when a regulation was instituted for doctors to report gonorrhea cases to public health authorities. Three main peaks occurred during the 20th century: in the 1910s, 1940s, and late 1960s.[2] The reported incidence of gonorrhea in 1970 was as high as 487 cases per 100,000 inhabitants, and gonorrhea was one of the most common notifiable infectious diseases during that time.[2] This was followed by many years of decline, mainly because of a decrease in endemic cases.[3] This decline has also been seen in Finland[4] and Norway.[5] In 1996, the incidence of gonorrhea in Sweden reached an all-time low of 2.4 cases per 100,000 inhabitants, but beginning in 1997 the incidence began to increase for the first time since 1976, as described elsewhere.[6] In short, the number of reported cases was 211 in 1996, 246 cases in 1997, and 343 cases in 1998 (3.9 cases per 100,000 inhabitants).

With better knowledge of the epidemiology of gonorrhea, efforts against spread can be more effective. By characterization of *Neisseria gonorrhoeae* strains, valuable information about gonococcal strains circulating in the community can be provided. To describe the reemergence of gonorrhea in Sweden, clinical epidemiologic data were obtained from each case of gonorrhea reported, and these data were compared with microbiologic characterization of isolated *N gonorrhoeae* strains. By this method, the epidemiology of gonorrhea could be better understood and the detection of core groups made possible, as has been seen by others.[7,8]

The aim of the study was to analyze the increase of gonorrhea in Sweden using epidemiologic data and microbiologic characterization.

Material and Methods

Gonococcal Strains

N gonorrhoeae strains isolated by routine methods at the clinical microbiologic laboratories in Sweden from February 1998 to January 1999 were included in the study. These laboratories report not only positive findings, but also the

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TABLE 1. Sex Distribution, Age, Route of Transmission, Place of Exposure of Patients With Gonorrhea in Sweden During Two 12-Month Periods*

	Heterosexual Women		Heterosexual Men		Homosexual Men		Total†	
	Period 1 (n = 48)	Period 2 (n = 59)	Period 1 (n = 140)	Period 2 (n = 205)	Period 1 (n = 52)	Period 2 (n = 88)	Period 1 (n = 246)	Period 2 (n = 357)
Case origin								
Domestic	35 (73%)	49 (83%)	51 (36%)	95 (46%)	34 (65%)	68 (77%)	121 (49%)	213 (60%)
Imported	12 (25%)	9 (15%)	86 (61%)	109 (53%)	17 (33%)	18 (20%)	117 (48%)	138 (39%)
Unknown	1	1	3	1	1	2	8 (3%)	6 (1%)
Age (y)								
Range	18–45	14–41	18–57	13–70	20–51	18–54	18–57	13–70
Mean	27	23	34	32	32	32	32	30
Median	26	23	32	30	30	32	31	29

*Period 1: January to December 1997 (n = 246); period 2: February 1998 to January 1999 (n = 357).
†For six men in period 1 and for five men in period 2, route of transmission is unknown.

total number of samples processed to the Swedish Institute of Infectious Disease Control (SMI). During the 12-month study period, approximately 33,000 persons were sampled (mean population in Sweden, 8.8 million persons).

Isolated *N gonorrhoeae* strains were sent to the Swedish National Reference Laboratory for Pathogenic *Neisseria*, Department of Clinical Microbiologic and Immunology, Örebro Medical Center Hospital, where one strain from each patient was serotyped using monoclonal antibodies.[9,10]

Epidemiologic Data

In the Swedish Communicable Diseases Act, it is stated that each case of gonorrhea has to be reported to SMI and to the County Medical Officer of Communicable Disease Control. Cases of gonorrhea diagnosed in Sweden from February 1998 to January 1999 were included in the study. A questionnaire was sent from SMI to the clinician reporting a case and asked for information regarding the route of transmission (homosexual or heterosexual), location of exposure (town and country) of the patient, place of residence (country) of the partner (if known), and the laboratory number of the *N gonorrhoeae* strain to link the epidemiologic data to the *N gonorrhoeae* strain that was isolated and serotyped.

Statistical Methods

The chi-square test was used for comparison of proportions of domestic cases per year, and the Mann-Whitney test was used for comparison of median age of women and men.

Results

During the study period, 380 cases of gonorrhea were reported to SMI and 370 *N gonorrhoeae* strains (one strain from each patient) were sent to the National Reference Laboratory from the clinical laboratories. In total, 393 cases of gonorrhea could be identified by report and isolated *N gonorrhoeae* strain (n = 357) or by either method (n = 36). In five reported cases, no *N gonorrhoeae* strain was isolated because the diagnosis was made by direct microscopy. In 18 reported cases, the isolated strain was not available for the reference laboratory. In 13 cases, a *N gonorrhoeae* strain was isolated and sent to the reference laboratory but no report was sent to SMI. In 357 cases, both epidemiologic data and the isolated strain were received and could be linked (i.e., in 91% of the cases, complete data were obtained). The following analysis is restricted to these 357 cases.

Of all 357 cases, 60% were domestic, which is significantly more than in 1997 (Table 1), with an increase of 76% ($P = 0.01$). Infected women are younger than both heterosexually and homosexually infected men ($P < 0.001$), and the majority of cases involving women are domestic. Domestic cases dominated in homosexual men, whereas heterosexual men were exposed abroad as often as in Sweden. The increase during the study period compared with 1997 was consequently due to domestic cases of young heterosexual men and women and of homosexual men.

Serogroup WII/III was predominant (90% of cases), followed by serogroup WI (10% of isolates). In total, 28 different serovars were identified. The most prevalent serovars are shown in Table 2. Among domestic cases involving heterosexual teenagers of both sexes, serovar IB-3 was the most common isolate, independent of where in Sweden the patients were exposed; however, 66% of these cases originated in the Stockholm area. Among homosexual men, no such predominant serovar could be seen. In this group of infected men, serovar IB-2 was the most frequent isolate in domestic cases, followed by serovars IB-5, IB-6, and IB-7. In all, 21 serovars were identified among domestic cases, 21 among heterosexual cases, and 10 among homosexual cases.

TABLE 2. Dominating Serovars and Identified Connected Domestic Core Groups of Patients With Gonorrhea in Sweden*

Serovar†	No. of Cases	Core Group
IB-3	86 (24%)	85 heterosexual cases: 55 men (median age, 22 y), 30 women (median age, 18 y), of which 72 were domestic
IB-2	44 (12%)	26 homosexual cases involving men (median age, 29 y), of which 19 were domestic; 18 heterosexual cases: 17 men (median age, 28 y), one woman (age 22 y) of which 12 were domestic
IB-1	31 (9%)	28 heterosexual cases: 23 men (median age, 34 y), five women (median age, 29 y), of which 11 were domestic
IB-6	28 (8%)	14 heterosexual cases: 11 men (median age, 36 y), three women (median age, 28 y), of which nine were domestic cases; 13 homosexual cases involving men (median age, 34 y), of which 10 were domestic
IB-5	27 (8%)	14 homosexual cases involving men (median age, 36 y), of which 13 were domestic; 12 heterosexual cases: 11 men (median age, 37 y), one woman (age 32 y), of which five were domestic
IB-4	22 (6%)	20 heterosexual cases: 16 men (median age, 28 y), four women (median age, 25 y), of which seven were domestic
IA-6	20 (6%)	18 heterosexual cases: 13 men (median age, 34 y), five women (median age, 25 y), of which seven were domestic
IB-26	18 (5%)	Seven homosexual cases involving men (median age, 32 y), of which five were domestic
IB-7	14 (4%)	10 homosexual cases involving men (median age, 34 y), of which nine were domestic
IB-33	11 (3%)	Seven homosexual cases involving men (median age, 30 y), of which six were domestic

*From February 1998 to January 1999, n = 357.
†A total of 56 cases (15%) represented 18 different serovars with less than 10 cases per serovar (IA-4, IA-8, IA-17, IA-21, IB-1.2, IB-8, IB-9, IB-10, IB-11, IB-12, IB-13, IB-21, IB-22, IB-24, IB-29, IB-31, IB-34, IB-35).

For domestic cases, Stockholm—the capital and the biggest city in Sweden—was the area of highest exposure (62% of cases), followed by the Göteborg area, the second largest city in Sweden (13% of the cases). The Stockholm dominance was seen especially in homosexual men, 82% of whom were exposed in the Stockholm area. During the study period, mostly single domestic cases were diagnosed in other counties of Sweden.

Among the imported cases, the heterosexual route of transmission was most common (118 of 138 cases, 86%). All continents, with the exception of Australia, were represented as areas of exposure. Forty-seven percent of cases were exposed in Asia, in which Thailand was the most prevalent country of exposure (36 of 65 cases), followed by the Philippines (11 of 65 cases). Europe was reported as place of exposure in 47 cases (34%). Only nine persons (6.5%), all of whom were heterosexual, were infected in Eastern Europe (including the Baltic States and other former areas of the Soviet Union). Homosexual exposure was reported only in Europe (14 cases) and America (4 cases). Among the *N gonorrhoeae* strains isolated from cases exposed abroad, 25 different serovars were identified. The nationality of sexual partners was reported in 66% of all cases. Of imported cases, 7% reported sexual contact with a Swedish partner abroad.

Discussion

The increase of gonorrhea in Sweden since 1997 is due to an increase of domestic cases. Imported cases remain at a similar level as in previous years. Domestic cases can be divided into two main groups of patients: heterosexual men and women in their teens infected by *N gonorrhoeae* strains of serovar IB-3, and homosexual men infected by *N gonorrhoeae* strains of serovar IB-2 and other serovars. The current study indicates that several *N gonorrhoeae* clones are endemic among homosexual men in Sweden. The clear preponderance of serovar IB-3 among heterosexual teenagers may indicate an introduction and spread of one clone of *N gonorrhoeae* in this population with no earlier exposure to the organism. Most cases of gonorrhea among teenagers were diagnosed in the large cities of Sweden, but during 1998 a spread to several counties was seen. At least in some cases, a sexual contact in Stockholm was identified for the primary case in small towns. It is not surprising that the introduction of an *N gonorrhoeae* strain among heterosexual teenagers will initially be spread only within this group, which contains the majority of their sexual contacts. The routine antibiotic sensitivity pattern for the IB-3 strains showed homogeneity, including full sensitivity to ciprofloxacin, the recommended therapy for gonorrhea in Sweden. Further studies of these strains with pulse-field gel electrophoresis will give an opportunity to study in more detail the homogeneity among the IB-3 serovar strains isolated from patients in different parts of Sweden during the entire study period. These analyses are in progress.

The majority of homosexual men (77%) were exposed in Sweden, as were the majority of the Swedish women infected with *N gonorrhoeae* (83%). This finding was in contrast to that in heterosexual men, only half of whom were exposed in Sweden. Obviously, some heterosexual Swedish men were infected abroad and transmitted this infection to their partners in Sweden. However, the spread of imported *N gonorrhoeae* strains is insignificant, which is in agreement with earlier experiences from Sweden.[3] An important reason for this finding may be that these persons, aware of their risk behavior, soon after their arrival in Sweden sought medical examination for diagnostic sampling and effective antibiotic treatment, which led to the accurate contact tracing of domestic contacts to these pa-

tients. It has previously been shown in Sweden that contact tracing of patients with genital chlamydial infection performed by specially trained staff is more effective than contact tracing by physicians.[11] Such specialists perform contact tracing at STD clinics in Sweden, where the majority of patients with gonorrhea are treated. From the perspective of contact tracing, there is no difference between discussions about chlamydia and gonorrhea with the patients.

Homosexual contacts were registered only from Sweden, Europe, and America. This finding is probably an underestimation of homosexual contacts, which in some countries may be illegal. In the present material, we found several cases among men from small towns with a serovar of *N gonorrhoeae* that was found almost exclusively among homosexual men. Of the isolated IB-2 strains from 44 patients, only one was a woman, but 17 of the men reported heterosexual contact. These findings indicate that among men infected with *N gonorrhoeae* in Sweden, homosexual contacts are not unusual. Without correct epidemiologic data, it is difficult to understand the epidemiologic situation. Furthermore, correct data concerning STDs are not easy obtain, even in Sweden, as indicated previously.

It is of interest that few cases of gonorrhea were exposed in Eastern Europe, including the Baltic States and other former areas of the Soviet Union. From these regions near Sweden, an increase in STDs has been reported,[12–14] but this has not yet had a great impact on the Swedish epidemiology of gonorrhea. Most imported gonorrhea cases originated in Asia, which may be due to sexual contacts with commercial sex workers in these areas.

The incidence of gonorrhea in Sweden is still increasing. It is important to continue the epidemiologic analysis to keep clinicians aware of the present situation so that they can ask adequate questions of their patients and perform the correct diagnostic procedures. Several of the persons with gonorrhea in this study were infected with both *N gonorrhoeae* and chlamydia. General practitioners have to be aware of gonorrhea, not only perform diagnostic samples for chlamydia (the most prevalent STD in Sweden), and treat the patients with adequate antibiotics or, preferably, send the patients with gonorrhea to STD clinics for treatment. Trained staff should perform contact tracing. This tracing may keep gonorrhea incidence at a low level in Sweden, which may in turn contribute to maintaining the low rate of pelvic inflammatory disease.[17]

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