EPIDEMIOLOGY

Epidemiology of urogenital infections caused by Chlamydia trachomatis and outline of characteristic features of patients at risk

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Summary. A study of Chlamydia trachomatis infection was conducted in two stages on 15656 subjects at urogenital clinics of the Faculty of Medicine and Surgery at La Sapienza University in Rome, the S. Anna Hospital in Turin, and the Niguarda Hospital in Milan. The overall incidence of the disease was 6.4% in patients examined throughout the whole study period. The rate of positive cases was 5.8% for the 5270 patients examined up to 1990, and 6.7% for the 10386 patients examined from 1990 to 1992, showing an increasing trend. There was a much higher positivity rate in men (9.8%) than in women (6.0%); the difference was statistically significant. Of all patients, 60% were asymptomatic. In symptomatic patients, C. trachomatis was present in 18.5% of cases of non-gonococcal urethritis and in 12.8% of cases of salpingitis. The highest incidence of C. trachomatis infection was in women who had begun sexual activity at an early age, (under 25 years in age), had several sexual partners and used intra-uterine contraceptive devices or spermicides or both.

Introduction

Four years ago, an initial study1 in three large Italian metropolitan areas assessed the spread of Chlamydia trachomatis infections and studied their epidemiological characteristics. In a further study, the number of subjects tested was enlarged, the epidemiological characteristics of the infections were examined and an outline of characteristic features of the subjects at risk was obtained.

Materials and methods

Patients

Overall, 15656 patients, comprising 14025 women and 1631 men, were examined: 5270 patients were studied from 1988 until 19901 and 10386 were studied from 1990 to 1992. All attended urogenital clinics of the School of Medicine and Surgery of La Sapienza University in Rome, the Santa Anna Hospital in Turin and the Niguarda Hospital in Milan. The patients were divided into two groups on the basis of presence or absence of genitourinary symptoms—cervicitis, pelvic pain, “spotting”, dyspareunia, dysuria, salpingitis, leukorrhoea or leukoxantorrhoea, in female patients; dysuria, proctitis, non-gonococcal urethritis (NGU), prostatitis, epididymitis or combined symptoms in male patients. Pregnant women and subjects needing surgical intervention were excluded from the study.

Each patient was assessed by completion of an epidemiological questionnaire, including the personal and medical history, and the following potential risk factors that could be correlated with disease attributable to C. trachomatis: present age, age at the time of first sexual intercourse, number of sexual partners during the previous 6 months and use of contraceptives.

Testing for C. trachomatis by an enzyme immunoassay

The Chlamydiazyme diagnostic kit (Abbott) was used for the direct detection of C. trachomatis antigen in endocervical swabs from women and urethral swabs from men.

Sample dilution buffer (1 ml) was added to the specimen and this was vortex mixed for 1 min in a test tube. Then 200 µl of a positive control, 200 µl of a negative control and 200 µl of each sample were pipetted into the wells in the reaction plate and one
Table I. Comparison between the frequency of cases of *C. trachomatis* infection in symptomatic and in asymptomatic subjects

<table>
<thead>
<tr>
<th>Clinical category</th>
<th>Males</th>
<th></th>
<th>Females</th>
<th></th>
<th>All (males + females)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number studied</td>
<td>Number (%) positive</td>
<td>Number studied</td>
<td>Number (%) positive</td>
<td>Number studied</td>
</tr>
<tr>
<td>Symptomatic</td>
<td>657</td>
<td>100 (15.2)</td>
<td>7613</td>
<td>520 (6.8)</td>
<td>8270</td>
</tr>
<tr>
<td>Asymptomatic</td>
<td>974</td>
<td>60 (6.2)</td>
<td>6412</td>
<td>319 (5.0)</td>
<td>7386</td>
</tr>
<tr>
<td>Total</td>
<td>1631</td>
<td>160 (9.8)</td>
<td>14025</td>
<td>839 (6.0)</td>
<td>15656</td>
</tr>
</tbody>
</table>

The statistical analysis was as follows. Difference in frequency of positive values; for males versus females: \( \chi^2 = 35.8; p < 0.001 \). Difference in frequency of symptomatic patients; for males versus females: not significant. Difference in frequency of symptomatic among positives; for males versus females: not significant. Difference in frequency of positives among patients of the same sex; symptomatic versus asymptomatic males: \( \chi^2 = 36.1; p < 0.001 \); females: \( \chi^2 = 21; p < 0.001 \).

Statistical analysis

The results were subjected to statistical analysis by the \( \chi^2 \) test for comparison between frequency distributions, with Yates' correction for continuity.

Results

The overall incidence of the chlamydia infection was 6.4% in the 15656 patients examined throughout the whole study period; the rate of positive cases was 5.8% for the 5270 patients examined up to 1990, and 6.7% for the 10386 patients examined from 1990 to 1992.

A comparison between the sexes showed a much higher frequency among men (9.8%) than among women (6.0%), and these differences were statistically significant (p < 0.001) (table I).
Table III. Frequency of positive results for *C. trachomatis* infection in relation to age in both symptomatic and asymptomatic subjects of either sex

<table>
<thead>
<tr>
<th>Age years</th>
<th>Symptomatic patients</th>
<th></th>
<th>Asymptomatic patients</th>
<th>p value*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number positive</td>
<td>Number negative</td>
<td>Total</td>
<td>Number positive</td>
</tr>
<tr>
<td><strong>Men</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 25</td>
<td>24</td>
<td>91</td>
<td>115</td>
<td>9</td>
</tr>
<tr>
<td>26-35</td>
<td>47</td>
<td>275</td>
<td>322</td>
<td>34</td>
</tr>
<tr>
<td>&gt; 36</td>
<td>29</td>
<td>191</td>
<td>220</td>
<td>17</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>100</td>
<td>557</td>
<td>657</td>
<td>60</td>
</tr>
<tr>
<td><strong>Women</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 25</td>
<td>209</td>
<td>79.1</td>
<td>1000</td>
<td>79</td>
</tr>
<tr>
<td>26-35</td>
<td>146</td>
<td>85.4</td>
<td>1000</td>
<td>64</td>
</tr>
<tr>
<td>&gt; 36</td>
<td>13.2</td>
<td>86.4</td>
<td>1000</td>
<td>5.2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>15.2</td>
<td>84.8</td>
<td>1000</td>
<td>6.2</td>
</tr>
</tbody>
</table>

**NS,** not significant.

* Statistical analysis of the differences compared to the frequency of positivity in asymptomatic men and women.

**Sex**

Table II indicates the difference in frequency of *C. trachomatis* positive reactions in relation to the symptoms and sex of patients.

The frequency of positive cases among men was higher (18.5%) in those with non-gonococcal urethritis and lower (10.3%) in those with prostatitis, whereas no positive results were detected in men with inflammation or dysuria or proctitis. The difference in frequency of positive cases, as between symptomatic and asymptomatic patients, was significant only for those with non-gonococcal urethritis.

Among symptomatic women, the frequency of positive results was higher in those with salpingitis (12.8%) and lower in those with pelvic inflammation (6.1%). The differences in positivity rates among asymptomatic female patients were all significant, except for those with "spotting" and inflammation (table II).

**Age**

Table III shows the incidence of proven *C. trachomatis* infection according to age group. The differences in positivity rates were similar for different age groups, although with different levels for men and women. These were: 20.9% of men and 8% of women aged up to 25 years; 14.6% and 7.4%, respectively, in those aged 26–35; 13.2% and 5%, respectively, for those over 36 years old.

The incidence of positive cases among symptomatic patients was higher than for asymptomatic ones, for all age-groups. The differences were significant for all age-groups, except for men up to 25 years.

**Age at first sexual intercourse**

Table IV presents the distribution of female patients according to their age at first sexual intercourse, their positivity for *C. trachomatis* infection and their symptoms. The positivity rate for *C. trachomatis* infection was inversely related to their age at first sexual intercourse, being highest (12%) in women who had had their first intercourse at an early age (< 15 years). The differences according to the age of the first sexual intercourse, for both chlamydia positivity and presence of symptoms, were statistically significant.

**Number of partners**

The frequencies of chlamydia positivity (21.7%) and presence of symptoms (38.5%) were higher among women who had had sexual intercourse with more than one partner during the previous 6 months than for those who had had only one partner in that period (table V). These differences were statistically significant in both cases.
Table IV. Distribution of positive cases of C. trachomatis infection in women in relation to age at first sexual intercourse and to presence of relevant symptoms

<table>
<thead>
<tr>
<th>Age at first sexual intercourse (years)</th>
<th>C. trachomatis test</th>
<th>Relevant symptoms*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number examined</td>
<td>Number (%) of positive results</td>
</tr>
<tr>
<td>&lt; 15</td>
<td>149</td>
<td>18 (12.1)</td>
</tr>
<tr>
<td>16-17</td>
<td>444</td>
<td>33 (7.4)</td>
</tr>
<tr>
<td>&gt; 18</td>
<td>7966</td>
<td>543 (6.8)</td>
</tr>
<tr>
<td>Total</td>
<td>8579</td>
<td>594 (6.9)</td>
</tr>
</tbody>
</table>

* See text.
† Difference in frequency of positivity among women in relation to age at first sexual intercourse.
‡ Difference in frequency of positivity and presence of symptoms among women in relation to age at first sexual intercourse.

Table V. Frequency of positivity for C. trachomatis infection in women and of relevant symptoms in relation to the number of sexual partners

<table>
<thead>
<tr>
<th>Number of partners</th>
<th>C. trachomatis test</th>
<th>Relevant symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number examined</td>
<td>Number (%) of positive results</td>
</tr>
<tr>
<td>1</td>
<td>7140</td>
<td>371 (5.2)</td>
</tr>
<tr>
<td>&gt; 1</td>
<td>736</td>
<td>160 (21.7)</td>
</tr>
</tbody>
</table>

* Difference in frequency of positivity among women in relation to the number of sexual partners.
† Difference in frequency of positivity and presence of symptoms among women in relation to the number of sexual partners.

Table VI. Frequency of cases positive for C. trachomatis and of relevant symptoms in relation to different methods of contraception used

<table>
<thead>
<tr>
<th>Contraceptive method</th>
<th>C. trachomatis test</th>
<th>Relevant symptoms</th>
<th>p value*</th>
<th>p value†</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number examined</td>
<td>Number (%) of positive results</td>
<td>Number examined</td>
<td>Number (%) with symptoms</td>
</tr>
<tr>
<td>Oral</td>
<td>2677</td>
<td>198 (7.3)</td>
<td>2295</td>
<td>818 (35.6)</td>
</tr>
<tr>
<td>Condom or diaphragm</td>
<td>1048</td>
<td>36 (3.4)</td>
<td>916</td>
<td>207 (22.6)</td>
</tr>
<tr>
<td>IUCD or spermicides</td>
<td>1163</td>
<td>95 (8.2)</td>
<td>973</td>
<td>256 (26.4)</td>
</tr>
<tr>
<td>None</td>
<td>8623</td>
<td>470 (5.4)</td>
<td>6857</td>
<td>1930 (28.1)</td>
</tr>
</tbody>
</table>

NS, not significant.
* Difference in frequency of positivity among women using contraceptives or not; † difference in frequency to presence of symptoms among women using contraceptives or not.

Contraception

Table VI indicates the relationship between positivity for C. trachomatis and the use of different methods of contraception. The highest percentage of positivity occurred among those using an intra-uterine device (coil) or a spermicide (8.2%) and the lowest in those using condoms or diaphragms (3.4%). The differences in frequency of positive cases, between women using and those not using contraceptives, were statistically significant.

Moreover, the frequency of symptomatic subjects varied in relation to the different methods of contraception used. The highest percentage was among those using oral contraceptives (35.6%) and the lowest in those using condoms or diaphragms (22.6%). The differences between the results for symptomatic women using contraceptives and the results for symp-
tomatic women who did not use them were statistically significant, except for those using intra-uterine devices or spermicides (table VI).

Discussion

As a result of the 4-year investigation, begun in 1988, it is possible to draw some conclusions, regarding the epidemiological characteristics, spread and risk factors of *C. trachomatis* disease in Italy, and concerning the relationship of these findings to those reported in other countries.

There are no national data in Italy on the occurrence of chlamydial disease because, in most cases, such infections are neither revealed nor reported officially. The present study, carried out in two stages, has shown that the overall incidence of the disease was 6.4% over the whole study period—5.8% up to 1990, and 6.7% from 1990 to 1992.

From this research, it is clear that chlamydial infection has been increasing in the three areas of Italy studied. In many European countries, on the other hand, the number of positive *C. trachomatis* cases seems to be decreasing. In Sweden, where genital chlamydial infections have been recorded since April 1988, the occurrence of disease has decreased in recent years. In Austria, where prostitutes are inspected periodically for sexually-transmitted diseases, the occurrence of chlamydial infections has decreased from 20.4% in 1980 to 2.2% in 1989, notwithstanding a slight increase (3.3%) recorded in 1991. In the former Soviet Union, data from Moscow indicate a decrease in positive cases, albeit from an initially high incidence, from 34% in 1989 to 26% in 1990 and 20% in 1991. The trend of infection recorded in the rest of Europe is decreasing, whereas, as already noted, it is increasing in the three Italian areas. However, it is difficult to compare our findings with those in various other European countries, because data available on genital infections caused by *C. trachomatis* varies according to sexual education, behaviour, and methods of prevention, diagnosis and treatment in different countries.

The trend that we have noted can be explained by taking into account the fact that epidemiological studies of the urogenital infections caused by *C. trachomatis* in Italy have become, in recent years, more specific, because of a better knowledge of the disease, improvements in diagnostic techniques, deeper understanding of major risk factors and better selection of patient samples. Moreover, our data show that a more relaxed attitude towards sexual activity, with associated lowering of age for first sexual intercourse and higher frequency of intercourse, both allowing a greater possibility of infection, contribute to the higher frequency of chlamydia-positive cases, both for men and women, in age groups up to 25. With regard to transmission, this has been facilitated by the fact that chlamydial urogenital infections are very often asymptomatic.

This research has shown that chlamydial disease in the three areas studied is asymptomatic in 60% of Chlamydiazyme-positive cases. This incidence is less than the 70% reported for the USA, but is more than the 5–20% reported in Sweden. The risk factors for infections caused by *C. trachomatis*, as reported elsewhere, are the same as for other sexually transmitted diseases, the main ones being sexual intercourse with many partners, or with only one who has promiscuous sexual habits. The present findings show that the risk is higher for women under 25 years of age (8.0%), who have had sexual intercourse before the age of 18 (12.1%), who have had many partners during the previous 6 months (21.7%), or who have used intra-uterine contraceptive devices or spermicides (8.2%). Thus, *C. trachomatis* infections seem to have affected the more sexually active women.

References

5. Shatkin A. Chlamydiad infections in Russia and former USSR.