

# Prevalence of Penicillinase-Producing *Neisseria* Gonorrhoeae (PPNG) in Seoul (1995)

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**Background :** In recent years gonorrhea has been pandemic and remains one of the most common sexually transmitted diseases(STD) in the world, especially in developing countries.

**Objective & Method :** For the detection of a more effective therapeutic regimen and to assess the prevalence of penicillinase-producing *Neisseria* gonorrhoeae (PPNG), we have been studying patients who have visited the VD Clinic of Choong-ku Public Health Center in Seoul since 1980 by means of the chromogenic cephalosporin method.

**Results :** In 1995, 97 strains of *N. gonorrhoeae* were isolated, among which 41(42.3%) were PPNG.

**Conclusion :** Since the prevalence of PPNG was reported as 21.9% in 1981, the rate fluctuated. However, in 1993, there was an increase up to 74.3%. Thereafter, the prevalence rate decreased to 64.3% in 1994 and 42.3% in 1995. These changes will therefore need continuous observation. (Ann Dermatol 9:(4):258~262, 1997).

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**Key words :** Gonorrhea, Prevalence, PPNG

In recent years gonorrhea has been pandemic and remains one of the most common sexually transmitted diseases in the world, especially, in developing countries.

*Neisseria gonorrhoeae* infects not only the mucous membrane of the genitalia and their adjacent organs, including the squamous epithelium of the vagina and rectum but also invades the oro-pharyngium and eyes and can cause disseminated infections inducing diverse symptoms<sup>1</sup>.

The increased resistance of *N. gonorrhoeae* to penicillins<sup>2,3</sup> and other antibiotics<sup>4,5</sup> and the rapid spread of penicillinase-producing *N. gonorrhoeae* (PPNG) strains<sup>6,7</sup> necessitate continuous intensive efforts to seek new effective regimens for gonorrhea.

Furthermore, the antibiotic susceptibility pattern of *N. gonorrhoeae* and the prevalence of PPNG varies greatly in different geographical areas<sup>8-11</sup> and

the plasmid contained on PPNG codes for production of  $\beta$ -lactamases also differs<sup>12</sup>. Therefore, the experience and knowledge of medically advanced nations do not provide immediate and sufficient help to less advanced countries, because strains circulating in developing countries are usually more resistant to most of the antibiotics used for gonorrhea in developed countries and the rate of PPNG among pretreatment isolates is still low in developed countries<sup>13,14</sup>. Therefore each country has to accumulate its own experience and knowledge on the subject and develop its own strategies for their gonorrhea problem.

For the detection of a more effective therapeutic regimen and to assess the prevalence of PPNG, we have been studying patients who have visited the Venereal Disease Clinic of Choongku Public Health Center in Seoul since 1980 by means of the chromogenic cephalosporin method.

## MATERIAL AND METHODS

### Patients

Male patients with suspected gonorrhea attending the VD Clinic at the Choong-ku Public Health

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**Table 1.** Prevalence of PPNG and annual comparison of the number of non-PPNG and PPNG strains isolated at the VD Clinic of Choong-Ku Public Health Center in Seoul, Korea (1981-1995)

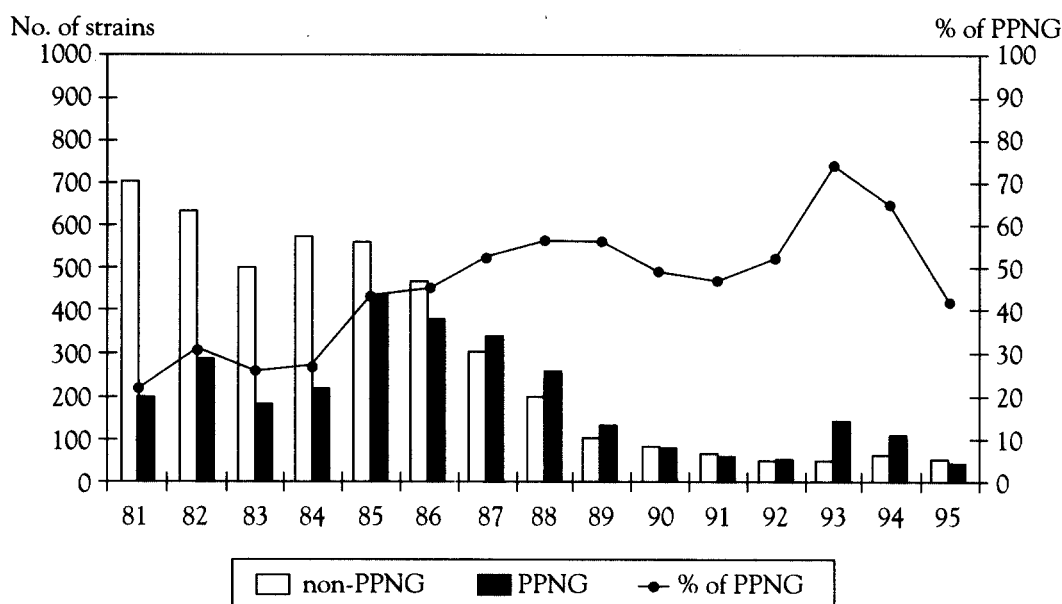
Year	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
N.G.	899	916	679	791	993	848	646	461	231	162	123	98	187	168	97
PPNG	197	283	178	214	429	378	339	258	130	80	58	51	139	109	41
(%)	21.9	30.9	26.2	27.1	43.2	44.6	52.2	56.0	56.3	49.4	47.1	52.2	74.3	64.9	42.3

N.G.: *Neisseria gonorrhoeae*, PPNG: Penicillinase-producing *Neisseria gonorrhoeae*

**Table 2.** Prevalence of PPNG and monthly comparison of the number of non-PPNG and PPNG strains isolated at the VD Clinic of Choong-Ku Public Health Center in Seoul, Korea (1995)

1995	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
N.G.	12	5	13	4	5	6	6	6	6	9	12	13	97
PPNG	7	4	5	0	2	2	4	2	2	4	4	5	41
(%)	58.3	80.0	38.5	0	40	33.3	66.7	33.3	33.3	44.4	33.3	38.5	42.3

N.G.: *Neisseria gonorrhoeae*, PPNG: Penicillinase-producing *Neisseria gonorrhoeae*

**Fig. 1.** Prevalence of PPNG and annual comparison of the number of non-PPNG and PPNG strains isolated at the VD Clinic of Choong-ku Public Health Center in Seoul, Korea (1981-1995).

Center in central Seoul between January 1995 to December 1995 were eligible to participate in the study.

Patients from whom *N. gonorrhoeae* was not identified prior to treatment or who had a history of allergy to the drugs tested in the trial or who had received antibiotics recently were excluded from the study. Patients with uncomplicated gonorrhea

showing intracellular Gram-negative diplococci from direct smears of urethral discharge and/or a previous positive culture for *N. gonorrhoeae* made up the study population of 97.

#### Isolation and Identification of *N. gonorrhoeae*

Before treatment, specimens for culture were obtained from the urethra with a sterile cotton-

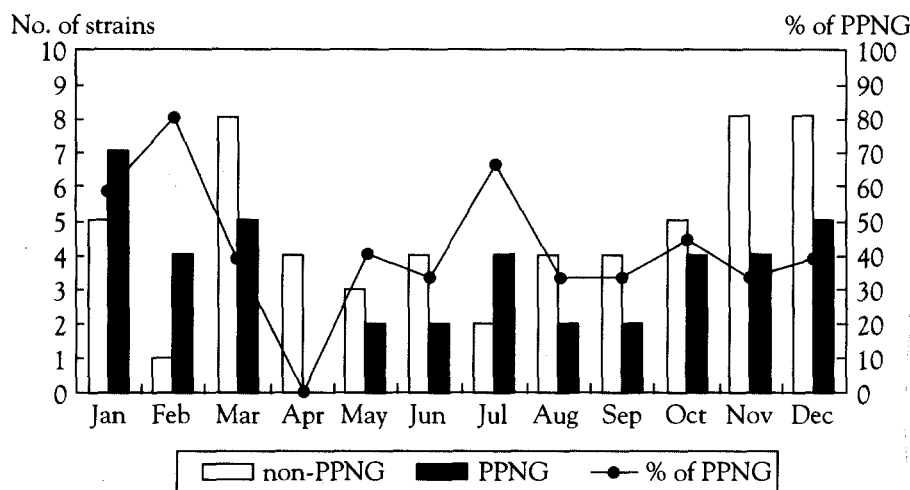


Fig. 2. Prevalence of PPNG and monthly comparison of the number of non-PPNG and PPNG strains isolated at the VD Clinic of Choong-ku Public Health Center in Seoul, area (1995).

tipped wooden stick, which was Z-streaked onto modified Thayer-Martin media by rolling the swab, cross-streaking it, and incubating it in a candle jar at 35 - 37°C for 24 - 48 hours.

The growth of colonies typical of *N. gonorrhoeae* that were shown to be gram-negative diplococci and that had a positive oxidase reaction were taken as sufficient evidence of the presence of *N. gonorrhoeae*.

#### Detection of $\beta$ -lactamase

For the detection of  $\beta$ -lactamase production by the colonies, a modified chromogenic cephalosporin test<sup>15</sup> was used. Reagent solution was made by dissolving Nitrocefim, 10mg (Nitrocefim, Glaxo, London) in 1ml of dimethylsulfoxide and adding 19ml of phosphate buffer at pH 7.0. The reagent solution was sterilized with a Millipore filter (pore size, 0.22 $\mu$ m) and kept at 4 - 10°C.

Several colonies were collected with a loop and smeared on a slide. Within 2 minutes a drop of the reagent solution was added. If the bacteria were  $\beta$ -lactamase-positive, an orange-colored cloud oozed out of the colonies within 30 sec. The colonies were classified as  $\beta$ -lactamase-negative if no color was produced within 15 min.

## RESULTS

We report here 97 strains of  $\beta$ -lactamase producing *N. gonorrhoeae* detected by the chromogenic cephalosporin method from Jan. 1995 to Dec.

1995 at Choong Ku Public Health Center in Seoul. In 1995, 97 strains of *N. gonorrhoeae* were isolated, among which 41 strains (42.3%) were PPNG (Table 1, Fig. 1). In January, 7 strains of PPNG (58.3%) were identified among 12 isolated; in February, 4 strains (80%) among 5; in March, 5 strains (38.5%) among 13; in April, 0 strain (0%) among 4; in May, 2 strains (40%) among 5; in June, 2 strains (33.3%) among 6; in July, 4 strains (66.7%) among 6; in August, 2 strains (33.3%) among 6; in September, 2 strains (33.3%) among 6; in October, 4 strains (44.4%) among 9; in November, 4 strains (33.3%) among 12; in December, 5 strains (38.5%) among 13 (Table 2, Fig. 2).

## DISCUSSION

The prevalence of domestic STD is on the increase due to some factors such as alterations in industrial structure, growth of population, corruption of sexual morality and increasing incidence of extra-marital affairs. Among STD, the prevalence of syphilis was shown to decrease dramatically from 2.5% in 1977 to 0.2% in 1995, whereas HIV-infected persons had reached the number of 512 in 1995 since first reported in 1985. In the case of gonorrhea, despite absence of precise prevalence data, the prevalence of gonorrhea is known to occupy more than half the incidence of domestic STD.

In the treatment of gonorrhea a single visit, where one shot treatment is administered, is pre-

ferred<sup>16</sup>. Over the years, penicillins have long enjoyed the place of first choice in the treatment of uncomplicated genital gonorrhea in spite of the decreasing sensitivity of *N. gonorrhoeae* to this drug. The emergence of penicillinase-producing *N. gonorrhoeae* (PPNG) changed the situation altogether especially in developing countries, where the prevalence became high.

PPNG was first reported in 1976 from the United Kingdom<sup>8</sup> and United States<sup>9</sup>. PPNG was first isolated in Korea by Hernandez<sup>17</sup> in 1978 from military personnel stationed in Korea and then by Chong<sup>18</sup> in 1979 from civilians. However, the number of isolated strains was rather too small to estimate the prevalence of PPNG in an area but thought to be below 1%.

A sudden rise of PPNG was observed in 1981 in Seoul<sup>19</sup>. The reason for this steep increase of PPNG is not clearly understood. Pidiack et al.<sup>20</sup> described a parallel sudden increase of PPNG rates among the isolates from military personnel stationed in Korea about 6 months ahead of this time. From zero percent in 1979-1980 the rate among the isolates tested at the Choong-Ku VD Clinic increased to a peak of 74.3% in 1993<sup>21-30</sup>. However, this increasing trend was not seen after 1993. The prevalence of PPNG in 1994 was 64.9%<sup>31</sup> and it fell below 50% in 1995. This decline is hard to explain. One might speculate that because of the high failure rate seen in the treatment of gonorrhea, the penicillins, especially oral penicillins, had not been used to the same extent as before for gonorrhea, thus reducing the selective pressure on penicillins. This, in turn, might have created a less favorable condition for the maintenance of beta strains among circulating *N. gonorrhoeae*. Another, but less likely, explanation for the observed drop in PPNG prevalence could be that patients consulting the VD Clinic in 1994 and in 1995 might not have come from the same population.

For the successful control of PPNG in Korea, the training of specialists and paramedics, prohibition of over-the-counter sales of antibiotics and quality control of laboratory methods are of paramount importance.

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