

Short Communication

Seroprevalence of Varicella, Measles and Hepatitis B among Female Health Care Workers of Childbearing Age

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(Received July 5, 2005. Accepted October 12, 2005)

SUMMARY: To evaluate the relation between infectious agents and reproductive health hazards for health care workers (HCWs), a cross-sectional study consisting of 73 HCWs and 65 bureau workers was conducted. The reproductive health problems of both groups were compared using a questionnaire, and serologic examinations for measles, varicella and hepatitis B were performed. There were no differences between the two groups according to the rate of seropositivity of measles and varicella ($P > 0.05$). The prevalence of anti-HBc seropositivity was significantly higher among HCWs than controls (31.5 versus 16.9%). There were no differences between seropositive and seronegative subgroups of measles, varicella and hepatitis B regarding the rates of normal delivery time, preterm and postterm delivery and stillbirth. Subjects seropositive for anti-HBc showed a higher spontaneous abortion rate than those who were seronegative (38.2 versus 16.3, $P = 0.009$). Although these data showed that HCWs had a high rate of anti-HBc seropositivity and that the rate of spontaneous abortion was associated with past hepatitis B virus infection, further studies including larger populations are needed. We considered that it should be strongly recommended that all HCWs be vaccinated against this virus, and future studies should be focused on the relationship between infectious diseases and reproductive health problems in HCWs.

Although little is known about the cause of the majority of reproductive health problems, we do know that certain workplace hazards can impact a woman's fertility and her ability to carry a pregnancy to full term, and can increase the risk of birth defects. Well-known female reproductive health hazards include radiation, certain chemicals and viruses, cigarettes, alcohol and some drugs, both legal and illegal. Varicella zoster virus (VZV) exposure in a nonimmune health care worker (HCW) can be a significant problem and can cause fetal growth restriction (1). Another infectious hazard to female personnel of childbearing age is measles. Data have suggested that health care personnel have a risk of measles that is 13-fold that of the general population (2). Measles is suspected to be associated with prematurity and abortion in female HCWs of childbearing age (3). In Turkey, 15,000-30,000 measles cases have been reported annually since the 1990s. Epidemics occur every 3-4 years, and $\geq 90\%$ of cases occur in individuals who are < 15 years old (4). The available data do not support the targeting of any other specific adult groups for measles vaccination (e.g., HCWs, university students). However, such groups may be targeted for measles vaccination if epidemiologic data show a need.

Hepatitis B infection is considered to be an occupational risk for HCWs. One factor believed to contribute to this high prevalence is exposure to the blood and blood products of infected patients. The enhanced risk of hepatitis B infection has been reflected by clusters of hepatitis B cases, high hepatitis attack rates, discrete outbreaks of hepatitis B, and a high prevalence of hepatitis B surface antigen (HBsAg) and

antibody (anti-HBs) (5). Hepatitis B can be transmitted from mothers who are positive for the HBsAg to the fetus. When mothers are also positive for hepatitis B e antigen (HBeAg), 90% of their infants will also have HBsAg (6). HBsAg positivity is still an endemic problem in Turkey; i.e., 5 and 10% of the population were positive for HBsAg and HBeAg, respectively (7).

We aimed to investigate the reproductive health problems of HCWs by using a questionnaire and measuring serologic markers for measles, varicella and hepatitis B. The results were evaluated in the light of the previous studies dealing with the relationship between infectious agents and the reproductive health hazards of HCWs.

From January 2005 to March 2005, 73 HCWs from the university hospital and state hospital of Duzce, which is located in the northern district of Turkey, were enrolled in this cross-sectional study. Thirty-four of the 150 female HCWs at the university hospital (22.6%) and 39 of the 180 subjects at the state hospital (21.6%) agreed to participate in the study. The Ethics Committee of the hospital approved the study protocol, and all subjects gave informed consent. Sixty-five female bureau workers were selected from different work places to serve as controls. The following information was obtained from the questionnaire designed for this study: age; occupation; work place; history of previous varicella, measles and hepatitis B; history of vaccination for measles and hepatitis B; previous pregnancies (preterm and postterm delivery, curettage, spontaneous abortion, stillbirth, birth weight) and teratogenic agents. Spontaneous delivery occurring before 37 completed weeks was defined as preterm and delivery after 42 weeks was defined as postterm.

Varicella and measles IgG levels were measured using commercial ELISA kits (Trinity Diagnostics, Jamestown, N.Y., USA). Varicella and measles immune status ratio (ISR)

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Table 1. The mean age; rates of pregnancy, delivery, curettage, spontaneous abortion and stillbirth; the mean weight of the children; and the ISR values of measles, varicella and hepatitis B of the health care workers and controls

| Parameters | Health care workers <i>n</i> = 73 | Controls <i>n</i> = 65 | <i>P</i> |
|---------------------------|--------------------------------------|---------------------------|----------|
| Age | 32.73 ± 5.35 | 37.30 ± 6.05 | <0.001 |
| Pregnancy | 2.19 ± 1.24 | 2.44 ± 1.50 | >0.05 |
| Delivery | 1.47 ± 0.66 | 1.64 ± 0.71 | >0.05 |
| Curettage | 0.36 ± 0.63 | 0.58 ± 1.01 | >0.05 |
| Spontaneous abortion | 0.30 ± 0.61 | 0.20 ± 0.40 | >0.05 |
| Birth weight | 3150.28 ± 622.41 | 3349.06 ± 534.41 | <0.05 |
| ISR values of measles | 2.44 ± 0.32 | 1.39 ± 0.64 | <0.001 |
| ISR values of varicella | 1.18 ± 0.27 | 0.89 ± 0.34 | <0.001 |
| ISR values of hepatitis B | 0.28 ± 0.24 | 0.12 ± 0.21 | >0.05 |

Values are mean ± SD.
ISR, immune status ratio.

levels were measured as described below. The cut-off values of varicella and measles were calculated as described in the instruction manuals, and the ratio of a sample's optical density to these cut-off values was accepted as the immune status ratio according to the manufacturer's advice. The communication of hepatitis B virus (HBV) was detected by the measurement of anti-HBc antibody levels (Vitros ECI; Ortho Clinical Diagnostics, Rochester, N.Y., USA). Anti-HBc-positive sera were tested for HBsAg and anti-HBs antibody levels. HBsAg-positive samples were evaluated for other hepatitis B markers using commercial kits (Vitros ECI; Ortho Clinical Diagnostics).

The chi-square and Fisher exact tests were used to determine statistical significance in the immune status ratio. The Student *t* test and the Mann-Whitney U test were used to compare the mean values. A *P*-value of less than 0.05 was considered significant.

The data on mean age, pregnancy, delivery, curettage, spontaneous abortion, stillbirth and birth weight, and the ISR of measles, varicella and anti-HBc antibodies of the HCWs and controls are shown in Table 1. The mean weight of the children of HCWs was significantly lower than that of the controls (*P* < 0.05). The mean ISRs of measles and varicella for HCWs were significantly higher than those of controls (*P* < 0.001).

The subjects' history of previous measles, varicella, hepatitis B, immunization for measles and hepatitis B, delivery, curettage, spontaneous abortion, stillbirth and delivery times, and their current seropositivity for measles, varicella and hepatitis B are shown in Table 2. A high immunization rate of hepatitis B was observed in HCWs (67.1%) when compared to controls (33.8%). The overall rates of seropositivity for measles and varicella were 91.3 and 97.1%, respectively. The prevalence of anti-HBc seropositivity was significantly higher among HCWs than controls (31.5 versus 16.9%). Among the subjects who were seropositive for anti-HBc (*n* = 34), three of them were HBsAg-positive (2 HCWs, 1 control) whereas the remainders were anti-HBs-antibodies-positive.

The mean data on birth weight, delivery time, preterm delivery, postterm delivery, spontaneous abortion and stillbirth in relation to the seropositivity for measles, varicella and hepatitis B are shown in Table 3. Subjects who were seropositive for hepatitis B showed a higher spontaneous abortion rate than those who were seronegative for hepatitis B (38.2 versus 16.3%, *P* = 0.009).

In the present study, similar rates of preterm delivery,

Table 2. The history of previous measles, varicella, hepatitis B, immunizations and reproductive health aspects of subjects

| Parameters | Health care workers <i>n</i> = 73 (%) | Controls <i>n</i> = 65 (%) | <i>P</i> |
|---------------------------------------|--|-------------------------------|----------|
| History of measles | | | |
| Yes <i>n</i> = 89 (64.5) | 45 (61.6) | 44 (67.7) | >0.05 |
| No/unknown <i>n</i> = 49 (35.5) | 28 (38.4) | 21 (32.3) | |
| History of varicella | | | |
| Yes <i>n</i> = 79 (57.2) | 43 (58.9) | 36 (55.4) | >0.05 |
| No/unknown <i>n</i> = 59 (42.8) | 30 (41.1) | 29 (44.6) | |
| History of hepatitis B | | | |
| Yes <i>n</i> = 6 (4.3) | 4 (5.5) | 2 (3.1) | >0.05 |
| No/unknown <i>n</i> = 132 (95.7) | 75 (94.5) | 63 (96.9) | |
| Immunization of measles | | | |
| Yes <i>n</i> = 70 (50.7) | 32 (43.8) | 38 (58.5) | >0.05 |
| No/unknown <i>n</i> = 68 (49.3) | 41 (56.2) | 27 (41.5) | |
| Immunization of hepatitis B | | | |
| Yes <i>n</i> = 71 (51.4) | 49 (67.1) | 22 (33.8) | <0.001 |
| No/unknown <i>n</i> = 67 (48.6) | 24 (32.9) | 43 (66.2) | |
| Delivery | | | |
| Yes <i>n</i> = 136 (98.6) | 72 (98.6) | 64 (98.5) | >0.05 |
| No <i>n</i> = 2 (1.4) | 1 (1.4) | 1 (1.5) | |
| Curettage | | | |
| Yes <i>n</i> = 42 (30.4) | 21 (28.8) | 21 (32.3) | >0.05 |
| No <i>n</i> = 96 (69.6) | 52 (71.2) | 44 (67.7) | |
| Spontaneous abortion | | | |
| Yes <i>n</i> = 30 (21.7) | 17 (23.3) | 13 (20.0) | >0.05 |
| No <i>n</i> = 108 (78.3) | 56 (76.7) | 52 (80.0) | |
| Stillbirth | | | |
| Yes <i>n</i> = 3 (2.2) | 1 (1.4) | 2 (3.1) | >0.05 |
| No <i>n</i> = 135 (97.8) | 72 (98.6) | 63 (96.9) | |
| Delivery time | | | |
| Normal <i>n</i> = 109 (80.1) | 59 (81.9) | 50 (78.1) | >0.05 |
| Preterm delivery <i>n</i> = 23 (16.9) | 13 (18.1) | 10 (15.6) | >0.05 |
| Postterm delivery <i>n</i> = 4 (2.9) | – | 4 (6.3) | <0.05 |
| Seropositivity of measles | | | |
| Yes <i>n</i> = 126 (91.3) | 64 (87.7) | 62 (95.4) | >0.05 |
| No <i>n</i> = 12 (8.7) | 9 (12.3) | 3 (4.6) | |
| Seropositivity of varicella | | | |
| Yes <i>n</i> = 134 (97.1) | 71 (97.3) | 63 (96.9) | >0.05 |
| No <i>n</i> = 4 (2.9) | 2 (2.7) | 2 (3.1) | |
| Seropositivity of hepatitis B | | | |
| Yes <i>n</i> = 34 (24.6) | 23 (31.5) | 11 (16.9) | <0.05 |
| No <i>n</i> = 104 (75.4) | 50 (68.5) | 54 (83.1) | |

Table 3. Reproductive features regarding seropositivity for measles, varicella and hepatitis B

| | Measles | | | Varicella | | | Hepatitis B | | |
|----------------------|------------------|------------------|-------|------------------|------------------|-------|------------------|------------------|-------|
| | + | - | P | + | - | P | + | - | P |
| Birth weight | 3244.84 ± 561.56 | 3233.33 ± 855.28 | >0.05 | 3255.76 ± 585.49 | 2850.00 ± 655.74 | >0.05 | 3263.64 ± 522.20 | 3237.48 ± 611.11 | >0.05 |
| Delivery time | | | | | | | | | |
| Normal | 99 (79.8) | 10 (83.3) | >0.05 | 107 (81.1) | 2 (50.0) | >0.05 | 28 (84.8) | 81 (78.6) | >0.05 |
| Abnormal | 25 (20.2) | 2 (16.7) | | 25 (18.9) | 2 (50.0) | | 5 (15.2) | 22 (21.4) | |
| Preterm delivery | | | | | | | | | |
| Yes | 21 (16.9) | 2 (16.7) | >0.05 | 21 (15.9) | 2 (50.0) | >0.05 | 5 (15.2) | 18 (17.5) | >0.05 |
| No | 103 (83.1) | 10 (83.3) | | 111 (84.1) | 2 (50.0) | | 28 (84.8) | 85 (82.5) | |
| Postterm delivery | | | | | | | | | |
| Yes | 4 (3.2) | - | >0.05 | 4 (3.0) | - | >0.05 | - | 4 (3.9) | >0.05 |
| No | 120 (96.8) | 12 (100.0) | | 128 (97.7) | 4 (100.0) | | 33 (100.0) | 99 (96.1) | |
| Spontaneous abortion | | | | | | | | | |
| Yes | 28 (22.2) | 2 (16.7) | >0.05 | 29 (21.6) | 1 (25.0) | >0.05 | 13 (38.2) | 17 (16.3) | 0.009 |
| No | 98 (77.8) | 10 (83.3) | | 105 (78.4) | 3 (75.0) | | 21 (61.8) | 87 (83.7) | |
| Stillbirth | | | | | | | | | |
| Yes | 3 (2.4) | - | >0.05 | 3 (2.2) | - | >0.05 | - | 3 (2.9) | >0.05 |
| No | 123 (97.6) | 12 (100.0) | | 131 (97.8) | 4 (100.0) | | 34 (100.0) | 101 (97.1) | |

spontaneous abortion, curettage and stillbirth were observed in both HCWs and controls. The mean weight of the infants of HCWs was significantly lower than that of controls. The prevalence of the seropositivity for measles and varicella was similar in both HCWs and controls, whereas the rate of seropositivity for hepatitis B among HCWs was higher than that of the controls. The ISR values of the measles and varicella were higher among HCWs. Subjects who were either HCW or control seropositive for anti-HBc antibodies showed a higher spontaneous abortion rate than those who were seronegative.

Although there was no significant difference between the two groups with respect to the prevalence of the seropositivity for measles, the immunity rates for measles among HCWs in our region were lower than those in other countries such as Italy (98.2%), Australia (98.3%) and Japan (98.5%) (8-10). The prevalence of varicella antibodies among HCWs in our region was similar to those reported for Italy (97.9%) and Japan (97.2%) (8,10). When evaluating the low prevalence of immunity to measles in HCWs in the Duzce region, we encountered problems with the routine vaccination program that was used in Turkey. A nationwide study by Kanra et al. (11) on the seroprevalence of measles in Turkey showed a lower value than that of the present study (59.6 versus 87.7%). They recommended that every effort should be made to increase the infancy vaccination coverage rate. Since a low immunity rate for measles among HCWs was observed in our region, these data indicate that it should be strongly recommended that all HCWs be vaccinated against (or have documented immunity to) these viruses in Turkey. Although it has been suggested that measles can cause prematurity and abortion, the present study showed no relationship between seropositivity for measles and preterm and postterm delivery, spontaneous abortion, or the mean birth weight of the children.

The immunity rate for varicella in our region was comparable with those in Japan and Italy (8,10). In the present study, preterm delivery, postterm delivery, spontaneous abortion and the mean birth weight did not differ depending on the seropositivity for varicella.

A study from Turkey involving 702 HCWs showed seroprevalence rates for HBsAg of 3.0% and for anti-HBs of

68.4% (12). In addition, they found the prevalence rates of HBV to be similar in both the HCWs and blood donors, and proposed that universal infection-control precautions and the encouragement of HBV vaccination reduces HCW infection with HBV and hepatitis D virus. In the present study, the rate of HBsAg positivity was 2.7% in the HCWs, whereas the same parameter was only 1.5% in the controls. The prevalence of anti-HBc seropositivity was found to be significantly higher among the HCWs than the controls (31.5 versus 16.9%). Our results suggested that HCWs had high exposure to the infectious agents when compared to the normal population. Moreover, a relationship was observed between the spontaneous abortion rate and seropositivity for hepatitis B.

In conclusion, despite disadvantages such as the small size of our sample population and the serological measurement of only three infectious agents, to the best of our knowledge, this is the first study dealing with the relationship between infectious agents and the reproductive health of HCWs. Our results showed that anti-HBc seropositivity in HCWs was considerably higher than in controls. Only the rate of spontaneous abortion was associated with past hepatitis B infection. We considered that it should be strongly recommended that all HCWs be vaccinated against this virus, and future studies should be focused on the relationship between infectious diseases and reproductive health problems in HCWs.

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