Seroprevalence and immunization history of selected vaccine preventable diseases in medical students

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Abstract

To evaluate protection against vaccine-preventable diseases in medical students, we obtained data on immunization status and history of diphtheria, tetanus, pertussis, poliomyelitis, measles, mumps, rubella, varicella and hepatitis B from students with elective periods in our institution. Further, serum antibodies against measles, mumps, rubella and varicella-zoster virus (VZV) and hepatitis B surface (HBs) antigen were determined on a voluntary basis. For students with incomplete immunization status or lack of protective antibodies, vaccination was offered for free. Success of catch-up immunizations was serologically confirmed 4 weeks later. From May 1999 to April 2003, 170 students were enrolled; their mean age was 26 years with a median of 25 years (range 22–48 years). Immunization records were complete in 148 (87%), incomplete in 11 (6.5%) and missing in 11 (6.5%) students. Only 26% of the cohort had a complete and up-to-date immunization status. Seroprevalence of IgG antibodies against measles, mumps, rubella, VZV and HBs ($\geq 10 \, \text{IU/l}$) in 149 students were 85, 85, 92, 97 and 90%, respectively. Indications for ≥ 1 catch-up immunization were found in 125 (74%) students and were accepted by 97 of them (78%). Sixty two (99%) of 63 immunized students available for follow-up demonstrated an adequate serological response. In conclusion, the great majority of medical students had immunization gaps. Systematic immunization programmes for medical students should be implemented.
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Keywords: Medical students; Immunization; Vaccines

1. Introduction

In hospital environments, transmittable infectious diseases put patients and health care workers at increased risk [1]. Therefore, most medical institutions do have immunization programmes for their staff in place. Medical students, who usually spend short periods of time in a particular institution, are also an important target group in this respective. Yet, this is frequently overlooked and only a few medical schools appear to have consistent and adequate immunization programmes for their students [2–6].

We have previously reported significant immunization gaps in medical students attending our hospital and provided suggestions for improvement [7]. In the meantime, more ex-perience has been gathered and also serological analyses have been performed. Here we report the findings of this pro-gramme, which has now been running successfully for four consecutive years.

2. Methods

2.1. Study population

Fourth year medical students with a rotation in the University Children's Hospital in Basel, Switzerland, were eligible for participation after informed consent. The following data were obtained during a standardized interview: age; gender; nationality; personal history of varicella, measles, mumps, rubella, and pertussis. Any written documentation of previous immunizations was requested and recorded.

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2.2. Serological assays

An initial venous blood specimen (3 ml) was obtained on a voluntary basis for specific serum antibody analyses. IgG antibodies against VZV were determined by ELISA (enzyme-linked immunosorbent assay, Enzygnost®, DADE Behring Ltd.) as were anti-measles and anti-mumps IgG antibodies (Human®, Wiesbaden, Germany). Anti-rubella IgG antibodies were determined by an enzyme immunoassay (PLATELIA® Rubella IgG, BIO-RAD, France). Anti-measles, anti-mumps and anti-rubella IgM antibodies were analyzed by solid-phase ELISA (Human®, Wiesbaden, Germany, and PLATELIA® Rubella IgM, BIO-RAD, France, respectively).

IgG antibodies against hepatitis B surface (HBs) antigen were measured by ELISA (MONOLISA® ANTI-HBS 3.0, BIO-RAD, France).

In students with no documentation of hepatitis B vaccination but positive anti-HBs antibodies, the respective serum specimens were tested for hepatitis B core (HBc) antibodies to distinguish between undocumented immunization and infection. Serotesting for anti-HBc IgG was performed with an ELISA (MONOLISA® ANTI-HBC 3.0, BIO-RAD, France).

All tests were performed and interpreted according to the manufacturers' instructions. Values in the indeterminate range were repeated and considered to be negative if still indeterminate.

2.3. Procedures

2.3.1. Interpretation of immunization status and consequent procedures

Immunity against diphtheria (D), tetanus (T) and poliomyelitis (P) was considered adequate if a primary immunization series (≥ 3) had been documented and the last dose had been administered ≤ 10 years ago. If less than 3 doses of either vaccine had been documented, missing dose(s) of immunization were recommended. A booster dose was suggested if ≥ 3 immunizations had been documented and the last dose had been administered ≥ 10 years ago. With respect to pertussis, immunization status was recorded but no booster doses were recommended in accordance with current recommendations in Switzerland.

2.3.2. Interpretation of serological results and consequent procedures

Immunity to measles, mumps, rubella and varicella was assumed based on the presence of specific IgG serum antibodies. If specific IgG antibodies against one or more of those viruses were lacking, a dose of MMR and/or varicella vaccine was offered irrespective of immunization and/or disease histories. To verify success of immunization, a further blood test was performed 4 weeks later and both IgG and IgM antibodies (as a surrogate for a primary immune response) were measured.

Immunity to hepatitis B was assumed in the presence of anti-HBs IgG antibodies of ≥ 10 IU/l serum, either documented previously or as part of this study. In all other cases a primary immunization series (in previously unimmunized individuals) or a booster dose was recommended and a further blood test were performed 4 weeks later. All recommended immunizations were offered free of charge.

2.4. Statistical analysis

Statistical analysis was performed using Epi-Info 2002 (version 1.1.2. Centers for Disease Control and Prevention, Atlanta, USA). Independent proportions were compared by Fisher's exact test or Mantel-Haenszel chi square analysis as appropriate. p values ≤ 0.05 were considered significant.

3. Results

3.1. Study population

From May 1999 to April 2003, 170 students were enrolled. Their mean age was 26 years (median: 25.3 years; range: 22–48) and 61% were females. One hundred thirty eight (81%) had grown up in Switzerland, 26 (15%) in Germany, 5 (3%) in Italy and 1 (1%) in Sweden.

3.2. Immunization status and seroprevalence

One hundred fourty-eight (87%) of 170 students provided complete documentation of all immunizations since childhood. Eleven (6.5%) students had no immunization records at all and the remaining 11 (6.5%) students only had records of specific recent immunizations, e.g. hepatitis B. In 149 students (88%) a voluntary serum sample was obtained.

A primary immunization series against diphtheria, tetanus and poliomyelitis was documented in 85–86% of students, whereas only 72, 79 and 59% of immunizations, respectively, were up-to-date. There were no significant differences by gender (data not shown).

In Table 1, vaccination rates and seroprevalence of specific IgG serum antibodies against measles, mumps and rubella are shown. As can be seen, 70, 64 and 61% of students had previously received one or two doses of measles, mumps and rubella vaccine, respectively. The rates for second doses ranged between 10 and 24%. Immunization rate for rubella was higher in female students (72%) compared to males (49%; $p = 0.01$). With respect to measles and mumps, no significant differences by gender were found.

Seroprevalence rates for IgG antibodies against measles, mumps and rubella were 85, 85 and 92%, respectively. Of students with a negative immunization status for measles, 96% had positive IgG antibodies compared to 81% ($p = 0.07$) in those with one or two previous immunizations. In contrast, unimmunized students had lower rates of mumps (74%) and rubella (75%) IgG antibodies compared to those with