Epidemiological impact of data management on prevention the accidents caused by exposure to blood in healthcare units

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Abstract: - The infections contracted in healthcare units due to the accidents caused by exposure to blood are the main causes of death and morbidity developed among hospitalized patients. This issue is one of the most serious problems of the Romanian healthcare system. Although large amounts of information are collected with reference to these infections, their processing is generally limited to a simple descriptive analysis, without making use of the varied instruments provided by epidemiology and statistics. The aim of this study is to exploit the information collected in the direction of an appropriate management of epidemiological data, in order to minimize the risk of this kind of infections in healthcare units, using computers and specific software for the collecting and analysis data. The study was carried out in the hospitals of Timisoara.

Key-Words: - surveillance, nosocomial infections, HBV (hepatitis B virus) infection, HCV (hepatitis C virus) infection, medical staff, accidents with blood exposure

1 Introduction
Nosocomial infections are a topical public health problem in Romania, an under-reporting of it being observed, which leads to an increase in the hospitalization duration and costs. Infections contracted in healthcare units are one of the main causes of death and morbidity developed among hospitalized patients. The medical staff is also continually exposed to the risk of infection, due to both the contact with the patient, and the hospital environment and risky manoeuvres. Any infection acquired by the medical and non-medical staff that is related to the healthcare unit in which they carry out their activities, is regarded as nosocomial. Although large amounts of information are collected with reference to these infections, their processing is generally limited to a mere descriptive analysis, without making use of the varied instruments.
provided by epidemiology and statistics. Likewise, in absence of a data quality system, the information is not always validated, and therefore there can be erroneous interpretations.

The aim of this study was to exploit the information collected in the direction of an appropriate management of epidemiological data, in order to minimize the risk of infection as a consequence of accidents of exposure to biological products by the personnel working in the healthcare system.

The objectives of this study are:

♦ Evaluation of the percentage of accidents involving exposure to biological products by the medical and non-medical staff in healthcare units in Timisoara;
♦ Application and testing of the database created for its utilization within the surveillance system for nosocomial infections;
♦ Hierarchic organization of medical categories running a high risk of accident, in order to establish further targeted surveillance;
♦ Evaluation of immunity following the administration of the anti-hepatitis B vaccine to the medical-sanitary staff;
♦ Estimation of the risk of infection with hepatic B and C viruses, and HIV, after the accidental occupational exposure, to blood or other blood products;
♦ Proposals and prophylactic measures to reduce the morbidity of these infections.

2 Materials and methods

Providing a valid surveillance system of accidents incurred by medical staff, is an important function of the hospital. There should be specific objectives (for units, services, patients, specific areas of healthcare) and periods of time for surveillance defined with accuracy for all partners: e.g. clinical units and laboratory staff, the physician/nurse in charge of controlling infections, manager and other.

Initially, the required information must be identified, with a view to establishing the indicators to be selected in order to contribute to the implementation of corrective measures.

The optimal method depends on the characteristics of the hospital, the objectives pursued, the available resources (computers, investigators) and the sustenance level of the hospital staff (both the administrative and the clinical one) [1].

The study comprised 417 persons (medical staff and auxiliary personnel) from hospitals in Timisoara.

For the collection of epidemiological information, a database was developed in the EpiData program. The collection of information was carried using standard questionnaires. After their validation, they were introduced and imported for analysis in the Epilnfo program [2].

For the laboratory diagnosis, the ELISA immunoenzymatic method was used for the identification of total HCV antibodies, HBs antigen (Ag HBS) and anti HBs antibodies (Ac HBs) in the serum.

The descriptive epidemiological inquiry, the time, place, person analysis has the practical purpose of identifying subjects affected by the disease and/or determining the number of persons with certain characteristics, exposed to potential causal factors [3].

The power of epidemiological association is measured by relative risk (RR) which shows how many times the risk of infection is higher in people who are exposed than in those who are not. Relative risk (RR): the ratio of absolute risks from two groups that we compare (if RR>1 then there is a strong connection between the risk factor and the disease).

In case-control surveys, the relative risk cannot be calculated directly because the risk of infection in exposed and non-exposed people cannot be measured. The proof of the strength of association can be made with the estimated relative risk OR (odds ratio).

The calculation formula is based on the number of ill and healthy persons exposed or not to the same presumed risk factors.

Attributable risk (AR) shows how many times the risk is higher in exposed versus non-exposed persons.

\[
AR(\%) = \frac{(OR-1)}{OR} \times 100
\]

When AR is below 0, the emphasized factor is not a risk factor, when AR is 0, the factor is neutral and when AR is above 0, the factor can be considered of risk.

When OR is lower than 1, the association is negative, when it is equivalent to 1 there is no association and when it exceeds 1, the association is positive [4].

The knowledge of the epidemiological association is positively involved in prophylaxis [5].
3 Results

The average age was 41 (Std. dev. = 9.75).

Figure 1 shows the relatively uniform distribution of the lot of investigated persons for three age groups: 25-34, 35-44 and 45-54.

![Fig.1. Age Distribution Group](image)

From figure 2 we can draw the conclusion that the lot consisted mostly of nurses (55%), followed by hospital attendants (20%) and physicians (18%).

![Fig.2. Professions Distribution Group](image)

The representation on specialty (Fig. 3) shows the prevalence of medical staff (55%), followed by the surgical one (24%).

![Fig.3. Specialty Distribution Group](image)

The percentage of subjects who suffered accidents from exposure to blood and biological products in the last 3 months was of 50%. 32.6% of the staff declared less than one accident by being pricked by contaminated needles, 22% by sharp cutting objects and 49.6% accidents by sprinkling.

The prevalence of accidents in various categories of medical staff was: 38% in physicians, 57% in nurses, 52% in hospital attendants and 17% in other categories of personnel. The difference is statistically significant, nurses having the higher risk of accident than physicians (OR = 2.12; 1.20<OR<3.74; p =0.05). Even though the risk is higher in nurses than it is in hospital attendants, the difference is not statistically significant.

While 41% of the nurses reported accidents by being pricked by contaminated needles in the last 3 months, in the case of physicians this percentage was lower than 18% and in hospital attendants it was lower than 35%. The risk of accidents was significantly higher in nurses than in physicians (OR = 3.03; 1.54<OR<6.05; p =0.0004), but also in hospital attendants as compared to nurses (OR =2.30; 1.04< OR< 5.12; p =0.02). A large proportion of these accidents occurs because of handling medical waste containers without complying with the legislative rules.

14% of the physicians had AES through cutting themselves with sharp objects, a lower percentage than in the case of nurses (27%) and hospital attendants (25%). Also in the case of this category of accidents, the risk in medical staff with secondary education was significantly than in physicians (OR =2.16; 1.02< OR< 4.65; p=0.03). The difference was insignificant among other professional categories.

37% of the physicians had accidents by sprinkling, in the last 3 months, as compared to nurses (57%), hospital attendants (48%) and other categories (25%). The secondary medical staff was found to run a significantly higher risk than physicians (OR =2.24; 1.27< OR< 3.98; p =0.03).

Table 1 illustrates the percentage per specialties of the various categories of accidents.

<table>
<thead>
<tr>
<th>Specialty type</th>
<th>% accidents in the last 3 months</th>
<th>% accidents by being pricked by needles</th>
<th>% accidents by cutting</th>
<th>% accidents by sprinkling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical</td>
<td>48</td>
<td>33</td>
<td>24</td>
<td>48</td>
</tr>
<tr>
<td>Surgical</td>
<td>63</td>
<td>42</td>
<td>23</td>
<td>60</td>
</tr>
<tr>
<td>Paraclinical</td>
<td>4.3</td>
<td>4</td>
<td>4</td>
<td>17</td>
</tr>
<tr>
<td>Other</td>
<td>56.5</td>
<td>27</td>
<td>21</td>
<td>54</td>
</tr>
</tbody>
</table>

The number of accidents was significantly larger in surgical specialties as compared to the medical ones (OR =1.92; 1.15<OR<3.21; p =0.007).
Considering the accident types, there have been no significant differences between the medical and the surgical staff in the case of prickling by contaminated needles and by cutting accidents, but the risk was much higher for the surgical staff than for medical one in the case of accidents by sprinkling on teguments and mucous membranes (OR = 1.84; 1.11<OR< 3.07; p = 0.01).

The share of antibodies for the hepatitis B virus (AcHBs with titre >10 mUI/ml), for the investigated medical-sanitary staff, was of 26.3%.

The prevalence of infections with HVB and HVC in medical-sanitary staff was of 3.8%, and 1.7% respectively.

Table 2 shows the prevalence of infections B and C hepatic virus on professional categories.

<table>
<thead>
<tr>
<th>Profession</th>
<th>No. of AgHBs positive cases</th>
<th>% HBV positive out of the total of positive (% of the profession)</th>
<th>No. of HCV positive cases</th>
<th>% HCV positive out of the total of positive (% of the profession)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physicians</td>
<td>1</td>
<td>6.3 (1.4)</td>
<td>3</td>
<td>42.9(4.1)</td>
</tr>
<tr>
<td>Nurses</td>
<td>5</td>
<td>31.3(2.2)</td>
<td>3</td>
<td>42.9(1.3)</td>
</tr>
<tr>
<td>Hospital attendants</td>
<td>8</td>
<td>50 (9.5)</td>
<td>1</td>
<td>14.3(1.2)</td>
</tr>
<tr>
<td>Other categories</td>
<td>2</td>
<td>12.5(25)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>16</td>
<td>100</td>
<td>7</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 3 shows the prevalence of infections with cu HVB and HCV on types of specialties.

<table>
<thead>
<tr>
<th>Specialty</th>
<th>No. of AgHBs positive cases</th>
<th>% HBV positive out of the total of positive (% of the specialty)</th>
<th>No. of HCV positive cases</th>
<th>% HCV positive out of the total of positive (% of the specialty)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical</td>
<td>7</td>
<td>43.8 (3)</td>
<td>5</td>
<td>71.4(2.2)</td>
</tr>
<tr>
<td>Surgical</td>
<td>5</td>
<td>31.3(4.9)</td>
<td>1</td>
<td>14.3(1)</td>
</tr>
<tr>
<td>Paraclinical</td>
<td>2</td>
<td>12.5(8.7)</td>
<td>1</td>
<td>14.3(4.3)</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>12.5(3.2)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>16</td>
<td>100</td>
<td>7</td>
<td>100</td>
</tr>
</tbody>
</table>

From the analysis of these results we can conclude that the prevalence of AgHBs was in other categories of staff and hospital attendants and the highest prevalence of AbHCV was in physicians. This is explained by a better specific immunity for the B virus in physicians (32.4%) and nursed (27.8%).

With regard to specialties, the highest prevalence of AgHBs was in the paraclinical specialty, followed by the surgical one, and for HCV antibodies, the paraclinical specialty followed by the medical one.

The positivity of HBs antibodies regarding the specialties, was of 19% in the medical one, 39.2% in the surgical and 30.4% in the paraclinical one.

The evaluation of the degree of association between different categories of accidents and the infections with B and C virus shows that accidents by cutting with sharp objects are significantly associated with the virus B infection (OR = 3.25; 1.07<OR<10.04; p = 0.02). Although the risk of being infected with the B virus is higher for those who had accidents by being pricked with contaminated needles, the relation is not significant (OR = 2.64; 0.86<OR<8.38; p = 0.05, Yates correction 0.1).

For a proper dimension of results and the monitoring of long-term tendencies, continuous surveillance is recommended [6].

Using of computer and specific software for the collecting and analysis data should be considered, since it will ensure a rapid and improved quality of the results. The integration of nosocomial infection surveillance into the category of frequently used data must be encouraged by identifying the specific necessities of the hospital’s information system.

5 Conclusion
A great prevalence of accidents involving a risk of transmitting some biological agents is observed in the medical staff. From this study we can conclude that the most exposed categories are: nurses, physicians and hospital attendants. The most frequent accidents were those by sprinkling on wounded teguments mucous membranes, followed by those involving prickling by contaminated needles.

The prevalence of AgHBs was of 3.8%, without differing greatly from the prevalence in the general population, but with higher values in hospital attendants and auxiliary personnel and in preclinical and surgical specialties. The prevalence of HCV antibodies was of 1.7 %, with higher values for physicians and in the preclinical and medical specialties.

The appropriate management of epidemiological data provides the necessary instruments for evaluation, the correction of surveillance and prophylaxis programs or for the introduction of new intervention strategies.

Educational programs are especially required for
secondary staff and auxiliary personnel, as well as the reiteration of vaccination campaigns, the surveillance of accidents and the evaluation of high-risk manoeuvres and devices.

The implementation of any surveillance system imposes continual evaluation for the identification of potential risks emerging for both the medical staff and the patients.

References: