Severe sepsis in intensive care units in Poland — a point prevalence study in 2012 and 2013

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Abstract

Background: Severe sepsis is associated with a high mortality rate, but the detailed epidemiology of sepsis is not well known in Polish hospitals. The aim of the study was to determine the prevalence and incidence of severe sepsis in Polish intensive care units (ICUs).

Methods: Two one-day, point-prevalence studies were performed on March 8th, 2012 and March 13th, 2013. An online questionnaire was sent to 320 accredited ICUs. Demographic data regarding hospitals, ICUs, number of patients with severe sepsis and septic shock, and number of patients mechanically ventilated with a central catheter or a urinary catheter were collected. The one-day prevalence of severe sepsis in ICUs was calculated, and the annual incidence of severe sepsis in Poland was estimated from the prevalence rate and the mean length of stay in ICUs.

Results: 1398 patients participated in the study in 2012, which accounted for 50% of all ICU beds registered by the National Health Care (NHC) system; 860 patients participated in 2013 (30% of all ICU beds). The daily prevalence of severe sepsis in ICUs was 26% in 2012 and 22% in 2013. Based on the data provided by the NHC system, the number of severe sepsis patients treated in accredited ICUs in Poland amounted to 24,905 patients per year, and the incidence of severe sepsis was 65/100,000 cases per year.

Conclusions: Severe sepsis was observed in one-fourth of patients treated in ICUs in Poland. However, the actual number of severe sepsis patients is at least 2 times higher because many patients with severe sepsis were treated outside accredited ICUs. Severe sepsis constitutes a major health problem in Poland.

Key words: severe sepsis, septic shock, prevalence, incidence, intensive care unit
The annual incidence ($I_a$) was calculated according to the following formula:

$$I_a = \frac{P_{dn}}{d} \times \frac{1}{365}$$

This method of determining severe sepsis prevalence and incidence has been used earlier in studies performed in Netherland [17] and Germany [18]. Descriptive statistics were applied for data analysis using Statistica 10.0 (StatSoft Inc. Tulsa, USA).

**RESULTS**

In 2012, questionnaires were sent to 300 ICUs; 244 questionnaires were completed and returned (76%), and 239 (98%) of those were valid, while 5 (2%) questionnaires were rejected due to incomplete data. In 2013, questionnaires were sent to 320 ICUs; 131 were completed and returned (41%). Of those, 128 (98%) questionnaires were valid, and 3 (2%) questionnaires were rejected due to incomplete data. In total, 367 questionnaires were included in the study. In 2012, data concerning 1,398 ICU patients were obtained, which corresponded to 50% of all ICU stations registered by the NHF. Patients with severe sepsis and septic shock
constituted 26% of all patients treated in ICUs (364 individuals), thus the national one-day prevalence of severe sepsis in ICUs was 728 patients. The annual incidence was (728/10) × 365 = 26,572 cases; extrapolated to the total population in Poland in 2012 (38,533 million), the resulting incidence was 69 cases of severe sepsis per 100,000 population or 0.69/1,000.

In the 2013 study, the data of 860 patients were obtained, which corresponded to 30% of the ICU stations registered by the NHF. The number of patients with severe sepsis and septic shock was 191, representing 22% of all patients treated in the reporting ICUs. The estimated one-day point prevalence in Poland was 614 patients. The estimated annual incidence based on data collected in 2013 was (614/10) × 365 = 232,388 cases; converted into the total Polish population in 2013 (38,496 million), the resulting incidence was 60 cases of severe sepsis/100,000 population, i.e., 0.6/1,000.

The mean annual prevalence of severe sepsis in ICUs in Poland, based on the data obtained from both studies (2012, 2013), was:

- the mean annual number of cases of severe sepsis in ICUs in Poland = 24,905 cases.
- the prevalence of severe sepsis in ICUs in Poland = 0.65 /1,000.

Among patients with severe sepsis, septic shock was recognised in 173 patients in 2012 (47%) and in 70 patients in 2013 (37%). The mean prevalence of septic shock in patients with severe sepsis in both studies was 44% (Table 1).

The mean number of ICU beds reported in the study was 7.7 in 2012 and 8.6 in 2013. Bed occupancy in the ICUs studied was 76% in 2012 and 78% in 2013. Device utilisation (DU) in ICUs was high in both 2012 and 2013 (Table 2). The percentage of intensive care stations in relation to all hospital beds was 2% on average (2.0% in county hospitals, 1.7% in regional hospitals, 2.1% in university hospitals, and 2.6% in others).

**DISCUSSION**

The prevalence of severe sepsis can be assessed using various methods, and the results can therefore markedly differ. In our study, a one-day point prevalence study of morbidity in ICUs was used. This method has some limitations, as a one-day picture does not include cases in which sepsis improved during treatment or those in which sepsis had not yet developed. However, when the reliable disease duration is known, the incidence of a given disease in the study population can be estimated; this was carried out in the present study based on the available data [10]. The method of estimating point prevalence is simple and allows the recruitment of many research centres and large numbers of patients, hence its popularity. A similar method has been used to determine sepsis prevalence in other countries [17, 19]. The results of studies those studies were comparable: 29% in Netherlands, 33% in Mexico, and 25% in Poland. The same method was also used to assess the prevalence of severe sepsis in Poland in 2006/2007 [11]. In that study, the prevalence rates of sepsis, severe sepsis and septic shock were evaluated. The prevalence of severe sepsis was 16%, which is substantially lower than that obtained in the present study, and that low prevalence may be the result of difficulties in diagnosing severe sepsis and in the differentiation between severe sepsis and sepsis. In our study, we identified severe sepsis based on SIRS criteria, which was abandoned due to low specificity. Thanks to the wider professional experience of ICU physicians in recognising severe sepsis and the precise criteria of organ failure diagnosis, our results are more reliable.

Table 1. Prevalence of severe sepsis and septic shock in Polish ICUs included in the study

<table>
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<tr>
<th></th>
<th>2012</th>
<th>2013</th>
<th>Total</th>
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<tbody>
<tr>
<td>Number of ICU patients</td>
<td>1398</td>
<td>860</td>
<td>2258</td>
</tr>
<tr>
<td>Number of patients with severe sepsis and septic shock</td>
<td>364 (26%)</td>
<td>191 (22%)</td>
<td>555 (25%)</td>
</tr>
<tr>
<td>Number of patients with septic shock alone (% of severe sepsis)</td>
<td>173 (47%)</td>
<td>70 (37%)</td>
<td>243 (44%)</td>
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Table 2. Device utilisation in intensive care units

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<tr>
<th></th>
<th>2012</th>
<th>2013</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Invasive mechanical ventilation</td>
<td>799 (57%)</td>
<td>608 (71%)</td>
<td>1407 (63%)</td>
</tr>
<tr>
<td>Central venous catheter</td>
<td>976 (70%)</td>
<td>755 (88%)</td>
<td>1731 (77%)</td>
</tr>
<tr>
<td>Urinary catheter</td>
<td>1040 (74%)</td>
<td>789 (92%)</td>
<td>1829 (81%)</td>
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In countries with high IC bed availability, the percentage is low, whereas in countries with limited availability of IC beds (such as Poland) this percentage is high. Monitoring the percentage of septic shock cases in further point epidemiological studies enables additional analysis of intensive care availability changes in healthcare systems.

Cohort studies enabling everyday assessment of the population analysed are more precise than one-day studies. However, such studies performed in various centres have shown highly divergent results with respect to ICU severe sepsis prevalence; reported results range from 12.4% in France [20] to 27.1% in Great Britain [21]. Cohort studies can underestimate the real number of severe sepsis cases, as they are usually confined to the population of patients treated in ICUs. According to American studies, this number represents only half of patients with severe sepsis in the population [1]. Additionally, cohort studies are believed to identify only 1/3 of ICU severe sepsis cases in Spain [22] and 1/4 of cases in Slovakia [23]. Calculations of severe sepsis incidence in the entire population based on ICU patients can differ depending on availability of ICU beds. In counties with low ICU bed availability, e.g., in Great Britain (8.6/100,000) or in Poland (7.1/100,000), the percentage of patients with severe sepsis in ICUs is high (27% and 25%, respectively). In the counties with high availability of ICU beds, such as the United States (38/100,000) and France (30/100,000), the percentage of patients with severe sepsis in ICUs is substantially lower (12%) [24]. Therefore, an estimation of the number of severe sepsis cases in the population based on the percentage of patients with severe sepsis in the ICUs is likely to carry the risk of error.

For this reason, epidemiological evaluation of sepsis is also based on administrative data, e.g., ICM-9 codes compiled in various ways — infections and acute organ dysfunction, bacteraemia and infections, etc. Such analyses allow the assessment of prevalence of severe sepsis in the entire population. However, depending on the database, information obtained using various administrative parameters can vary up to 3.5-fold [25].

According to the first classic epidemiological study on severe sepsis in the United States, the prevalence of severe sepsis in the population was 3/1,000 a year [1]. The next population-based study showed a slightly lower prevalence — 2.4/1,000 [26]. Another study carried out in Norway and based on hospital administrative data reported a sepsis prevalence of 1.5/1,000 [27]. In the cohort study performed in Great Britain, the number of patients admitted to ICUs with severe sepsis was found to be 0.5/1,000 [21] whereas in Australian and New Zealand studies the prevalence of severe sepsis was 0.77/1,000 [28]. The prevalence rates estimated based on one-day studies in Netherland [17], Germany [18] and Poland were similar — 0.54/1,000, 0.75/1,000 and 0.65/1,000, respectively.

According to our results, the annual incidence of severe sepsis in Poland is estimated at approximately 25,000 patients treated in ICUs. Because the number of patients in the population can be 2- to 4-fold higher than the number of those treated in ICUs, the total number of patients with severe sepsis is at least 50,000 a year. This number is consistent with the estimates presented in the previous Polish publication [11]. Mortality due to severe sepsis is extremely high, reaching up to 50% [9,10] (i.e., at least 25,000 cases a year; the death rate due to severe sepsis for the entire population is at least 65/100,000). This rate is higher than the real death rate due to cancers of the trachea, bronchi and lungs (58.6/100,000) or myocardial infarction (49.4/100,000) in Poland [7].

The present study supplemented data provided by the recent 7-year observational study in patients with severe sepsis in ICUs [10]. Both studies explicitly reveal that severe sepsis is one of the most dangerous health problems, both in the population of patients treated in ICUs and in the general population.

CONCLUSIONS
1. One-fourth of patients treated in ICUs in Poland (25%) had symptoms of severe sepsis.
2. Almost half of patients with severe sepsis treated in ICUs (44%) developed septic shock.
3. The annual prevalence of severe sepsis in ICUs is high, at 65/100,000 individuals.
4. Severe sepsis is a major therapeutic problem in ICUs and a serious medical challenge for the entire healthcare system in Poland.

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3. The authors declare no conflict of interest.

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5. The World Sepsis Declaration; www.world-sepsis-day.org


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