Secular trends in candidemia-related hospitalization in the United States, 2000-2005

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Reviewed work(s):
Source: Infection Control and Hospital Epidemiology, Vol. 29, No. 10 (October 2008), pp. 978–980

Published by: The University of Chicago Press on behalf of The Society for Healthcare Epidemiology of America

Stable URL: http://www.jstor.org/stable/10.1086/591033
Accessed: 19/04/2012 17:10

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In the United States, from January 1, 2000, through December 31, 2005, the incidence of candidemia-related hospitalization per 100,000 population rose by 52%, from 3.65 to 5.56 cases; and the incidence per 1,000 hospitalizations rose by 49%, from 0.28 to 0.42 cases. The proportion of all candidemia-related hospitalizations in which candidemia was the principal diagnosis remained stable at approximately 14%.

RESULTS

The number of adult discharges from US hospitals with a diagnosis of candidemia rose from 10,299 in 2000 to 16,500 in 2005, equating to a population incidence of 3.65 cases per 100,000 in 2000 to 5.56 cases per 100,000 in 2005 (Table). We noted approximately an order of magnitude difference in the candidemia-related hospitalization incidence between the youngest group (1.42 cases per 100,000 population among those aged 18–44 years) and the oldest group (17.29 cases per 100,000 population among those aged at least 85 years) in the year 2000, a relationship that persisted throughout the study period (Table). Each group experienced a similar rise in the incidence of candidemia-related hospitalizations from January 1, 2000, through December 31, 2005: an increase of 41% among people aged 18–44 years, 50% among those aged 45–64 years, 49% among those aged 65–84 years, and 45% among those aged at least 85 years.

An examination of the trends in the incidence of candidemia-related hospitalizations compared with the total annual number of hospitalizations in the United States yielded similar results, although, for the oldest group, the rise in hospitalization incidence was greater than the rise in the population incidence (51% increase vs 45% increase) (Table). In the analysis of candidemia as the principal diagnosis, the percentage of total candidemia-related hospitalizations in which candidemia was the principal diagnosis remained stable at approximately 14% during the study period (Figure). Although minor fluctuations in the proportion of total candidemia-related hospitalizations in which candidemia was the principal diagnosis were noted for the 3 younger groups, the fluctuations seen among the group aged at least 85 years were more pronounced, ranging from 28.9% in 2001 to 15.4% in 2004 (Figure).

DISCUSSION

We have documented an approximately 50% increase in the incidence of hospitalization with candidemia in US hospitals.
from January 1, 2000, through December 31, 2005. Consistently, the highest incidence was seen in the oldest group of patients and the lowest incidence in the youngest. Although the proportion of candidemia-related hospitalizations in which candidemia was the primary diagnosis remained stable overall, substantial fluctuations were noted for the oldest group of patients.

Candida species are recognized as important causes of bloodstream infections, particularly among critically ill and immunocompromised patients. A recent systematic review documented that the attributable mortality for candidemia ranged from 5% to 71%, and survivors of this disease incur substantial increases in the duration and the costs of hospitalization. Furthermore, although in 1990 nearly 80% of isolates representing candidemia were *Candida albicans*, more recently this percentage has decreased to less than 50%, raising the probability of resistance to azoles. Because of these clinical and economic implications of bloodstream infection due to *Candida*, it is critical to understand its epidemiologic trends, and our data provide the needed generalizable information on the current state of the population incidence of hospitalization with infection due to this evolving pathogen.

Several prior investigations reported trends in candidemia-related hospitalizations over time both in the United States and abroad. For example, Martin et al. utilizing the ICD-9-CM codes 117.9 (disseminated fungal infection), 112.5 (disseminated candidiasis), and 112.81 (candidal endocarditis), documented a substantial rise in fungal sepsis incidence in the United States between 1979 and 2001. Because this study did not report specifically on candidemia, we are unable to

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**Table.** Annual Population Incidence and Hospitalization Incidence of Candidemia-Related Hospitalization, by Age Group, United States, 2000–2005

<table>
<thead>
<tr>
<th>Incidence measure, patient age group</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of cases per 100,000 population</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18–44 years</td>
<td>1.42</td>
<td>1.53</td>
<td>1.80</td>
<td>2.20</td>
<td>2.26</td>
<td>2.01</td>
</tr>
<tr>
<td>45–64 years</td>
<td>4.53</td>
<td>5.06</td>
<td>5.97</td>
<td>6.16</td>
<td>6.66</td>
<td>6.81</td>
</tr>
<tr>
<td>65–84 years</td>
<td>12.52</td>
<td>14.16</td>
<td>15.51</td>
<td>16.84</td>
<td>16.49</td>
<td>18.64</td>
</tr>
<tr>
<td>≥85 years</td>
<td>17.29</td>
<td>17.32</td>
<td>19.46</td>
<td>21.48</td>
<td>21.86</td>
<td>25.01</td>
</tr>
<tr>
<td>No. of cases per 1,000 hospitalizations</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>18–44 years</td>
<td>0.16</td>
<td>0.17</td>
<td>0.20</td>
<td>0.25</td>
<td>0.25</td>
<td>0.23</td>
</tr>
<tr>
<td>45–64 years</td>
<td>0.38</td>
<td>0.43</td>
<td>0.49</td>
<td>0.51</td>
<td>0.55</td>
<td>0.57</td>
</tr>
<tr>
<td>65–84 years</td>
<td>0.38</td>
<td>0.41</td>
<td>0.46</td>
<td>0.50</td>
<td>0.50</td>
<td>0.57</td>
</tr>
<tr>
<td>≥85 years</td>
<td>0.29</td>
<td>0.28</td>
<td>0.33</td>
<td>0.37</td>
<td>0.39</td>
<td>0.43</td>
</tr>
</tbody>
</table>

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**Figure.** The proportion of all candidemia-related hospitalizations in which candidemia is the principal diagnosis, by age group (in years), 2000–2005.
make direct comparisons with our results with regard to the magnitude of change. Other studies from abroad have noted increases in the incidence of hospitalization with candidemia that were similar in magnitude to the increase in our study.9

Our analysis has multiple limitations. It relied on ICD-9-CM coding to identify candidemia-related hospitalizations, which may have predisposed our case ascertainment to misclassification. Although the accuracy of the coding for candidemia is unknown, giving credence to our numbers is the report by Zaoutis et al.,9 who, in an approach similar to ours, noted candidemia incidence to be 30 cases per 100,000 adults hospitalized in the United States in 2000; in our analysis we found 28.3 cases per 100,000 hospitalizations in the same year. Additional support is provided by the relative stability over time of the proportion of all candidemia-related hospitalizations in which candidemia was the principal diagnosis. Nevertheless, the administrative nature of the data set is likely to have resulted in an underestimate of the full burden of candidemia.

The incidence of candidemia has risen by 50% in the time period between 2000 and 2005, and age-adjusted estimates confirm a rise among all adult age groups. Given the magnitude of attributable morbidity, mortality, and costs of this disease, the implications of this increase are likely not trivial. Our findings, in combination with reports of the increasing incidence of recovery of azole-resistant isolates from patients with candidemia, should compel a closer examination of this emerging disease and its impact on patient and systemwide outcomes.

ACKNOWLEDGMENTS

Potential conflicts of interest. All authors report no conflicts of interest relevant to this study.

REFERENCES