Prevalence of infections and their risk factors in geriatric institutions: a one-day multicentre survey*

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This one-day prevalence survey of 1919 patients (74% females and 44% aged ≥ 85 years) in nine geriatric hospitals, six of them located in France and three in Switzerland, indicated a high prevalence of infections in elderly institutionalized patients (infection rate: 18.7% in males and 15.4% in females). The risk factors for infection were identified and the relative risks assessed.

Prevention of infections in geriatric wards should be one of the goals of every care-giver. A low rate of infection in elderly inpatients is thus likely to be associated with care of good quality.

Introduction

The world population of over-60-year-olds, which was 370 million in 1980 and 415.6 million in 1985, is expected to increase to 1100 million in the year 2025. 6 This fact, together with our changing values on life and the inevitable socioeconomic challenges in the future, will produce major difficulties in the health field (1, 2). Of the many problems related to human aging, two are investigated in the present collaborative study: institutionalization of the elderly and increased infections in this age group.

In western Europe (3) and the USA (4), 5–6% of the elderly live in nursing homes with geriatric facilities, in old-age homes, or in long-stay hospitals. Usually, this age group is the most disabled and economically less favoured, and care-givers aim to improve the quality of life in this population (5), in spite of reduced functional capacities and multiple symptoms and signs of disease (6, 7).

The present study focuses on the increased susceptibility to infection among the elderly who are in institutions. Although infectious diseases are not usually recognized to be associated with old age (8), they are a major cause of death in this age group (9). Since infectious diseases are not easily diagnosed because of their atypical manifestations in the elderly (10), they are often neither efficiently prevented nor correctly treated (11).

Nine geriatric hospitals collaborated in the investigation of the prevalence of infectious diseases in their patients, identifying the risk factors of infection and establishing a prospective programme for more appropriate care. The results of this one-day prevalence survey carried out by the participating institutions on 17 December 1987 are presented and discussed below.

Methods

The survey was conducted on the same day in nine geriatric teaching hospitals located in France and Switzerland, the majority of them being associated with a University. Investigators in each of the participating centres filled in a simple questionnaire on their inpatients (both infected and not infected) concerning age, sex, presence or absence of infection and, for infected individuals, the site of infection. In addition, six of the nine hospitals recorded for all patients the presence of any factors that favoured infection. Diagnosis of infection conformed to the guidelines established by the U.S. Centers for Disease Control (12).


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In each hospital the questionnaires were filled in by residents or doctors in charge of the patients and were revised by the responsible investigator and mailed to the coordinating centre for statistical analysis (University Geriatric Institutions, Geneva, Switzerland).

Prevalence of infection was determined as the ratio of the number of infected cases detected on the survey day to the total hospitalized population investigated on that day. Specific infection rates were also determined by sex, age group, and site of infection. Infection rates by site were calculated separately for patients affected and not affected by the corresponding risk factors. As hospitalized patients may not constitute a population representative of the association between potential risk factors and infection, the estimated odds ratios and their variances were used to approximate the values of relative risks and their 95% confidence intervals (13).

The χ²-test was used to evaluate the significance of differences between infection rates, for all compared groups and subgroups. The statistical significance was fixed at the 0.05 probability level.

**Study population**

On the day of the survey, 1919 elderly patients in the nine participating centres were investigated. On average, 9.7% of them were in short-stay wards, 21.2% in wards awaiting discharge, and 69.1% in long-stay wards. This distribution is representative of the usual bed categories in French and Swiss geriatric institutions.

The proportion of female patients varied between centres from 66% to 81% (Table 1) and the proportion of patients aged 85 years or more from 38% to 56%. The between-centre variation in prevalence of infection (shown in the last column of Table 1) was found to be linked with differences in the relative distribution of ward categories, lower infection rates usually being observed in the short-stay wards. As an earlier review of the survey results did not reveal an association between infection rate and the investigated parameters, data were pooled for further analysis.

**Results**

Out of the 1919 patients surveyed, 507 were males (26.4%) and 1412 females (73.6%). The mean age (± SD) was 81.0 (± 7.6) years for males and 83.8 (± 7.0) for females. As shown in Table 2, one third of the male subjects (32.5%) and almost half of the females (48.4%) were 85 years old and over (P < 0.001). The rate of infection was higher for males (18.7%) than for females (15.4%), but the difference was not statistically significant (P < 0.05). While the rates did not differ substantially between the two lower age groups, they reached their highest level among the male and female patients of the oldest age group (85 years or more); the difference between age groups was statistically significant for females (P < 0.05).

The distribution of the 362 reported infections according to the site affected is presented, by sex, in Table 3. The highest prevalence was observed for the urinary tract (39.5%), followed by respiratory tract infections (27.9%) and skin infections (16.0%). Less than 20% of all infections were of other types, and the relative frequency did not reach 5% for any other recognized site of infection (Table 3).

The order of infection types by decreasing importance was the same for both males and females. No significant sex difference was observed between infection prevalences. As indicated in the

**Table 1: Sex and age distribution of hospitalized patients and the proportions infected, by centre**

<table>
<thead>
<tr>
<th>Participating centres*</th>
<th>No. of patients</th>
<th>% of females</th>
<th>Age distribution (%)</th>
<th>% infected</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>&lt;85 years</td>
<td>&gt;85 years</td>
</tr>
<tr>
<td>Collonge-Bellerive (CH)</td>
<td>91</td>
<td>65.9</td>
<td>61.5</td>
<td>38.5</td>
</tr>
<tr>
<td>Dijon (F)</td>
<td>345</td>
<td>70.4</td>
<td>52.5</td>
<td>47.5</td>
</tr>
<tr>
<td>Libourne (F)</td>
<td>106</td>
<td>71.7</td>
<td>66.0</td>
<td>34.0</td>
</tr>
<tr>
<td>Loéx (CH)</td>
<td>351</td>
<td>67.5</td>
<td>57.3</td>
<td>42.7</td>
</tr>
<tr>
<td>Marseilles (F)</td>
<td>137</td>
<td>72.3</td>
<td>56.2</td>
<td>43.8</td>
</tr>
<tr>
<td>Metz (F)</td>
<td>156</td>
<td>77.6</td>
<td>62.2</td>
<td>37.8</td>
</tr>
<tr>
<td>Paris (F)</td>
<td>318</td>
<td>80.8</td>
<td>57.9</td>
<td>42.1</td>
</tr>
<tr>
<td>Thônes (CH)</td>
<td>307</td>
<td>75.9</td>
<td>50.8</td>
<td>49.2</td>
</tr>
<tr>
<td>Valence (F)</td>
<td>108</td>
<td>79.6</td>
<td>44.4</td>
<td>55.6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1919</strong></td>
<td><strong>73.6</strong></td>
<td><strong>55.8</strong></td>
<td><strong>44.2</strong></td>
</tr>
</tbody>
</table>

* CH = Switzerland; F = France.
last line of Table 3, the mean number of infections was 1.16 per infected patient (362 infections for 312 patients), slightly more for males (1.22) than for females (1.13). Forty patients had 2 infections while 5 patients had 3 infections. All the 45 polyinfected subjects (e.g., 14.4% of those with infection or 2.3% of all the investigated elderly) suffered at least from one respiratory or urinary or cutaneous infection; for 25 of them, the second infection was also one of these three main types of infection, while 20 patients were affected by a second and/or a third infection of another less frequent type.

In six centres, the presence or absence of suspected potential risk factors was recorded for 1170 subjects (169 infected and 1001 free of infection). Table 4 shows that, among the risk factors tested, the most prevalent were psycho-behavioural disorders, which were reported for 658 patients (56.2% of the total number); the three factors next in importance were nutrition abnormalities, diabetes, and chronic bronchitis, which were observed in 15.6%, 9.6%, and 8.5% of all patients, respectively. As expected, in the majority of instances, the infection rate was higher among subjects with potential risk factors. Table 4 shows that the difference in patients with or without risk factors was statistically significant for persons with difficulties in swallowing (P < 0.001), chronic bronchitis (P < 0.01), nutrition abnormalities (P < 0.001), or requiring a urethral catheter (P < 0.001) or intravenous catheter (P < 0.001). The infection rate was particularly high (greater than 40%) in subjects who had swallowing difficulties or required a urethral or intravenous catheter. The suspected role of a recent cerebral vascular accident, induced immunodepression, and neoplasm was not statistically confirmed, although the infection rates were substantially higher in the patients who were affected by these conditions. In this study, infection did not appear to be associated with parkinsonism, diabetes, or steroid therapy.

Patients presenting with diagnosed psycho-behavioural disorders had a lower infection rate (12.5%) than those without such a diagnosis (17.0%). One possible explanation of this unexpected finding is that certain high-risk factors may be more frequently associated with the absence than the presence of psycho-behavioural disorders. Thus, a relatively large proportion of patients with psycho-behavioural disorders may have been admitted to the hospital because they no longer had the mental capacity to take care of themselves, while many patients without a psycho-behavioural disorder had to be admitted because of their poor physical condition.

Table 5 shows that, in general, significant risk factors for infection did not affect uniformly the respiratory tract, urinary tract, or other systems. The relative risk, as approximated by the odds ratio (O.R.), was particularly high for infections of the respiratory tract among patients with swallowing problems (O.R. 5.74), chronic bronchitis (O.R. 5.00), or intravenous catheter (O.R. 5.49). The
patients most at risk for infection of the urinary tract were those with a urethral catheter (O.R. 8.75) and those with a swallowing problem (O.R. 4.15). Among patients with psycho-behavioural troubles, the odds ratio was significantly lower than 1 for only infections of the urinary tract. This might indicate that catheters were used less frequently in demented patients, because of the higher risk of manipulation and removal by this category of patients. Furthermore, it is highly probable that symptoms of dementia were more frequently observed among patients admitted for medico-social problems than among those admitted for physical problems, including incontinence.

**Discussion**

Prevalence studies of infectious diseases in the elderly are rare (14) and the “one-day prevalence study” is not commonly used in geriatrics (15, 16), although it is a simple and specific method of study. As the results from this type of survey must be as precise as those that define both physical signs and diseases, three meetings were organized before the study with the persons in charge of each selected geriatric centre in order to ensure a common terminology. Precise criteria were applied for items such as infection, swallowing disorders, chronic bronchitis, nutrition abnormalities, etc. For example, the malnutrition syndrome described a cachexic status, which was identified by a loss of >10% of the body weight in the previous 6-month period based on the Master weight table (17), or a loss of 10 kg in the last 3 months and/or a serum albumin level of less than 30 g/l (18).

The surveyed population represented the largest group ever included in a “one-day prevalence study”. As usual, the female patients were more numerous and older than male patients. There was no evidence of a sex differential in the general health status of the subjects investigated; this contrasts with
the higher percentage of infections observed in male patients. It has been suggested that the higher tendency of infections in men could be related to a greater decrease of immune function in this sex, or linked with an increasing prevalence of risk factors favouring infection (19–21). In both sexes, the infection rates did not increase substantially with "advancing age".

The findings of seven other studies, summarized in a review of the literature (22), revealed that urinary and respiratory tracts, followed by skin, were among the most commonly infected sites in elderly patients. In our survey, 83% of all infections involved these three sites, while a similar proportion (89%) was reported by others (23).

With regard to the very high infection rates displayed in Table 4 for patients with an intravenous catheter (61.5% versus 13.9% for patients not exposed to this risk factor) and those with a urethral catheter (51.1% versus 12.9% for non-exposed patients), it is interesting to note that comparable rates were observed in another survey (23): 87.5% versus 12.8%, respectively, for patients with and without an intravenous catheter, and 50.0% versus 13.6%, respectively, for patients with and without a urethral catheter.

It should be noted that the date of the study was determined by common agreement, and that the staff was not told of it until one day before the survey, thereby preventing any pre-investigation or change of attitude. For example, urinary tract infections were defined in patients with a demonstrated positive urinary culture (bacteriuria > 10^5/ml) and/or in patients treated on the day of the study. When this criterion could not be applied, the investigators were invited to adhere to the guidelines established by the U.S. Centers for Disease Control (see the section on Methods): it is, for instance, well known that there is no simple non-invasive bacterial investigation method for lower and upper respiratory tract infections, and therefore standard criteria cannot be rigorously applied in a "one-day prevalence study". Despite this difficulty, the results from the various geriatric centres were similar (no statistically significant differences were observed in the between-centre distributions of the sites of infection).

An interesting feature of this study was the survey of old people with or without the suspected risk factors for infection in their geriatric institutions. This analysis could only be made on approximately two thirds of the population studied (about 1200 subjects).

For a correct appraisal of the situation, which is required to develop and implement suitable policies and programmes for prevention and care, it is important to clearly distinguish between the prevalence of risk factors and the corresponding level of risk for infection. Fig. 1 shows that the most prevalent risk factors were not necessarily associated with the highest odds ratios for infection. Relative risks larger than 3 were noted for catheters and swallowing disorders, but only for the latter factor did the prevalence rate reach 5% of the total investigated population. Among the other potential risk factors reported for more than 5% of the subjects, nutrition abnormalities and chronic bronchitis were characterized by significantly positive odds ratios (respectively, 2.66 and 2.14). It has been well demonstrated that the elderly usually constitute a poorly nourished population with high rate of protein-energy deficiency (18). Malnutrition

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Fig. 1. Prevalence and relative risk of factors suspected to favour infection among the elderly.

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of protein origin can increase the risk of infection even in institutionalized old people (24). Factors of comparable prevalence like recent stroke, neoplasim, or diabetes did not appear to favour infection in a statistically significant way.

Two important factors were not investigated in this study: the place where the patient was infected (nosocomial versus community-acquired infection), and the duration of hospitalization at the time of the survey. A second multicentric one-day survey was carried out in 1988 to collect information on the role of these two factors in the process of infection and the results are being analysed.

Conclusions
This one-day prevalence survey of 1919 patients in nine geriatric hospitals in France and Switzerland has confirmed the high prevalence of infections among them. The risk factors for infection were identified and the relative risks assessed.

The study has indicated the need for basic treatment of certain frequently neglected symptoms or signs of disease. For example, (1) the origin of swallowing disorders must be detected, their etiology correctly established, and appropriate care given (especially oral and dental hygiene); (2) the nutritional intake of these patients must be closely followed and nutrient supplements must be given when necessary; (3) appropriate oral care is essential for normal feeding and to avoid having to use an intravenous catheter; (4) the limitations of urinary catheters must be recognized.

Prevention of infections in geriatric wards should be one of the goals of every care-giver. A low rate of infection in elderly inpatients is thus likely to be associated with care of good quality.

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Résumé
Infection et facteurs de risque dans les institutions gériatriques: résultats d’une enquête multicentrique

Une enquête menée le même jour, simultanément auprès de 1919 patients hospitalisés dans neuf institutions gériatriques suisses et françaises, a révélé une prévalence globale d’infection de 16,3%. Le taux a été plus élevé chez les hommes (18,7%) que chez les femmes (15,4%), mais la différence n’a pas atteint le seuil de probabilité statistiquement significative (0,05).

Près de 40% des infections affectaient les voies urinaires, 30% le système respiratoire et 16% la peau. L’ordre des systèmes affectés s’est trouvé être le même chez les hommes et les femmes.

Un objectif important de l’enquête était l’identification des principaux facteurs de risque associés à l’infection et à sa localisation. Les facteurs potentiels investigués les plus fréquemment rapportés ont été les troubles psycho-comportementaux observés chez 56% des patients, suivis par la dénutrition, le diabète et la bronchite chronique, respectivement notés chez pratiquement 16%, 10% et 9% de l’ensemble des patients gériatriques.

Comme on pouvait s’y attendre, dans la majorité des cas, des taux d’infection plus élevés ont caractérisé les patients qui se trouvaient exposés aux facteurs de risque. En particulier, des différences de prévalence statistiquement significatives entre les deux catégories de patients (exposés ou non aux facteurs de risque) ont été relevées pour les troubles de la déglutition, la bronchite chronique, la dénutrition, les cathéters et la sonde urinaire. Le rôle favorisant d’autres facteurs tels que l’accident cérébro-vasculaire récent, l’immunodépression induite et la néoplasie, n’a pas été statistiquement confirmé, bien que des taux d’infection nettement plus élevés aient été observés chez les patients qui en étaient affectés.

La prévalence de l’infection s’est trouvée négativement associée au diagnostic de troubles psycho-comportementaux, mais la corrélation n’était significative que pour l’infection des voies urinaires, ce qui pourrait s’expliquer par la pose moins fréquente d’une sonde urinaire chez les patients déméntifiés, à cause du risque de manipulation, ou par une meilleure condition physique chez ces patients, dont l’hospitalisation est souvent liée à des problèmes psycho-sociaux.

Les facteurs de risque significatifs n’étaient pas associés uniformément aux infections des différents systèmes. Par exemple, chez les patients souffrant de troubles de la déglutition, le risque relatif a été particulièrement fort (5,74) pour les infections du système respiratoire, alors que les patients avec sonde urinaire ont accusé le risque relatif le plus élevé (8,75) pour les infections des voies urinaires.

Pour le développement d’une stratégie préventive et curative efficace et la mise en place de programmes adaptés, il y a lieu de distinguer, d’une part, la prévalence des facteurs favorisant l’infection et, d’autre part, leur risque relatif respectif, les facteurs à plus haut risque.
n’étant pas toujours les plus communs.
L’enquête a confirmé l’existence d’une forte prévalence de l’infection dans les institutions gériatriques et la nécessité d’un meilleur contrôle de quelques facteurs favorisants, tels que les troubles de la déglutition, le recours aux cathéters et à la sonde urinaire.

References