Delay in the Diagnosis of Bacteraemic Urinary Tract Infection in Elderly Patients

T. M. S. BARKHAM, F. C. MARTIN, S. J. EYKYN

Summary
Collaboration between clinicians and microbiologists revealed that many patients with subsequently proven urinary tract infection (UTI) present with symptoms suggestive of chest infection. A retrospective analysis was performed on patients over 50 years old with community-acquired bacteraemic UTI proven by blood cultures. The main presenting features were confusion (30%), cough (27%), dyspnoea (28%) and new urinary symptoms (20%). The initial clinical diagnosis was UTI in 43% and chest infection in 24%. Chest infection was diagnosed more often in those over 70 years old than those aged 50–70 years old ($\chi^2 = 7.2$, $p = 0.007$). The majority had pyuria but less than half of the urine samples arrived in the laboratory on the day of admission, fewer from the older patients than the younger ($\chi^2 = 2.57$, $p = 0.10$).

These results demonstrate that UTI frequently presents with respiratory features and that the diagnosis of UTI is often delayed. Sampling the urine with a catheter may be justified to enable diagnosis on the day of admission.

Introduction
It is long-standing practice in St Thomas’ Hospital, London that medical staff from the Microbiology Department visit all patients with positive blood cultures and keep clinical and microbiological records of their progress. From this close involvement arose the observation that many older patients who were acutely unwell with Gram-negative bacteraemia of urinary origin had been initially treated on the supposition of respiratory tract infection. These diagnoses, although based on respiratory signs and symptoms, were often made without convincing abnormalities on the chest radiograph. This study was undertaken to investigate this observation.

Methods
Clinical and laboratory data were extracted from the records kept in the microbiology department of patients over 50 years old with community-acquired bacteraemic urinary tract infection (UTI) seen between 1990 and 1993. Patients who were catheterized and those from whom no urine sample had been sent to the laboratory were excluded. While the records in the microbiology department were of sufficient detail with respect to most events, the clinical notes were examined for details of the presenting signs and symptoms recorded by the admitting clinician, results of urine microscopy written in the notes on the day of admission and the use of chest radiography. Fever was defined as a temperature over 37.5°C measured by any means. The study population was divided into those aged between 50 and 70 years and those over 70 years. Data from these two groups were compared with the $\chi^2$ test.

Results
One hundred and four patients fulfilled the inclusion criteria. The majority had been admitted to the general medical and elderly care wards. The clinical notes were available for 49 of the 104 patients. Table I shows the diagnoses on admission. An initial clinical diagnosis of chest infection was made more commonly in the older age group ($\chi^2 = 7.2$, $p = 0.007$). Table II shows the presenting clinical features. Respiratory symptoms were more common in the older group but this did not reach statistical significance ($\chi^2 = 1.79$, $p = 0.18$). Confusion was more common in patients aged over 70 ($\chi^2 = 3.5$, $p = 0.05$).

Thirty-one patients (80%) aged 50–70 years and 41 (63%) over 70 years had a fever ($\chi^2 = 3.0$, $p = 0.07$). Twenty-three patients were treated with amoxycillin or erythromycin, in eight cases despite an initial clinical diagnosis of urine infection. Of the 49 patients whose clinical notes were available, 33 had chest radiography requested. Fourteen were noted as normal, five as showing abnormal shadows and in 14 cases the result was not recorded in the clinical notes.

All 104 patients had a urine sample taken but only 48 samples reached the laboratory on the day of admission. Of the 45 patients with an initial diagnosis of urinary infection fewer urine samples reached the laboratory on the day of admission from the older patients (13/27) than from the younger patients (13/18) ($\chi^2 = 2.57$, $p = 0.10$). Urine microscopy showed over 500 leucocytes/µl in 75 samples (72%) and over 10 leucocytes/µl in 94 (90%). Of the 48 patients whose urine samples
reached the laboratory on the day of admission, 18 sets of clinical notes were found and in only four (22%) cases was the urine microscopy result recorded in the admission notes.

The commonest isolates were Escherichia coli (80), Klebsiella sp. (7) and Proteus sp. (6). Forty-five per cent of the isolates were resistant to amoxycillin and 23% resistant to trimethoprim. Twenty-three (59%) patients aged 50 to 70 years and 45 (74%) over 70 years old had a peripheral leucocytosis (> 11 x 10^9/l)(x^2 = 2.8, p = 0.1).

### Table I. Age, sex and admitting diagnosis for 104 patients with proven bacteraemic urinary tract infection

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>50–70</th>
<th>&gt; 70</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total no.</td>
<td>104</td>
<td>39</td>
</tr>
<tr>
<td>Men</td>
<td>30</td>
<td>15</td>
</tr>
<tr>
<td>Women</td>
<td>74</td>
<td>24</td>
</tr>
<tr>
<td>Admission diagnosis*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UTI</td>
<td>45</td>
<td>18</td>
</tr>
<tr>
<td>Chest infection</td>
<td>26</td>
<td>4</td>
</tr>
<tr>
<td>Other†</td>
<td>47</td>
<td>20</td>
</tr>
</tbody>
</table>

* Some patients had more than one diagnosis.
† In some cases an infective illness was not initially considered.

### Discussion

The results support the original observation that a large minority of elderly patients with subsequently proven bacteraemic UTI present with signs and symptoms of chest infection and are treated accordingly. As symptoms suggestive of chest infection and non-specific symptoms were twice as frequent as urinary symptoms it is easy to see how the attending clinicians were distracted from considering the diagnosis of UTI. Junior doctors may be unaware that in elderly patients chest signs and symptoms are often long-term and neither specific nor exclusive to infection and that it is important to distinguish between old and new symptoms [1]. Nevertheless, it is well known that UTI is a common cause of hospital admission of elderly patients and should be actively excluded. This emphasizes the importance of obtaining a urine specimen and taking note of the microscopy result in older patients who are acutely unwell. Clinicians may prefer to use a dipstick for urinanalysis to avoid the delay inherent in sending samples to the laboratory. Various investigators have come to different conclusions as to the use of dipsticks in different populations to indicate either the presence or the absence of UTI [2–8]. Whilst the negative predictive value of a dipstick may approach 90–100%, the positive predictive value may be less than 30% and we feel that a positive result should be confirmed by routine microscopy and culture.

Twenty-three patients were treated with amoxycillin or erythromycin. Not only is erythromycin poorly excreted into the urine (approximately 5%) but it is inactive against urinary pathogens. Amoxycillin is excreted into the urine at high concentrations but 45% of urinary pathogens in this study were resistant to it. Amoxycillin was therefore a poor choice for the initial treatment of urinary infection in these patients. Eight patients were given these antimicrobials despite an initial clinical diagnosis of UTI.

Urine samples were more likely to reach the laboratory on the day of admission from patients aged between 50 and 70 years than from those over 70. While it is easy to collect urine samples from young patients it is often difficult in elderly patients because of confusion, immobility and incontinence. Catheterization, specifically to sample the urine, should be considered if the patient is unable to provide a specimen. In this series 90% of the urine samples had over 10 leucocytes/μl and 72% had over 500 leucocytes/μl. If these results were known to the admitting clinician then the diagnosis of UTI would have been reached on the day of admission in the majority of cases instead of in less than half.

There is a widely held belief that elderly patients do not mount either a febrile or a peripheral leucocyte response to infection, a misconception that dates to antiquity, as Hippocrates said ‘Old men have little heat, . . . the fevers of old men are less acute than others, for the body is cold’ [9]. The majority of patients (69% of the total 104) had a fever but this may have been an underestimate since the measurement of temperature of
elderly patients is prone to error. Many elderly patients are hypothermic or afebrile on admission yet are found to be febrile once they have been in a warm hospital bed for 24 hours [10, 11]. Not only did 74% of the patients over 70 years old mount a leucocytosis but in 23% it was over 19 x 10^9/l.

The pathophysiology of the respiratory signs and symptoms in these patients is of interest. We have mentioned above that chest signs may be chronic or without obvious cause. Some patients may have had a concomitant chest infection or a degree of heart failure with pulmonary oedema that was exacerbated by sepsis. Some may have suffered from fever-associated tachypnoea. A further possibility is that these patients suffered from sepsis-associated pulmonary endothelial damage. The pathogenesis of sepsicaemia is related to the systemic activation of numerous effector cells (e.g. neutrophils, endothelial cells) and the inappropriate release of mediators of inflammation, cytokines. Inflammatory reactions are inherently destructive and can become harmful rather than beneficial. While the complex interactions between leucocytes, cytokines and endothelium work well to combat 'local' problems, the fine homoeostatic control cannot be sustained once the inflammatory response spills over into the circulation. This results in widespread endothelial recruitment of activated neutrophils which release toxic mediators that damage the endothelium with deleterious effects on tissues or organs distant from the original insult [12–14]. The effect on the lungs is to cause pulmonary oedema with its associated signs and symptoms.

While the respiratory presentation of urinary infection has been noted in a sizeable number of patients, this study only included those with positive blood cultures. The proportion of patients admitted with a presumptive diagnosis of respiratory tract infection that actually have a UTI is unknown. The clinical relevance of these misdiagnoses is that not all urinary pathogens are susceptible to the antimicrobials commonly used to treat chest infections, hence an initial choice of an inappropriate antimicrobial might delay the clinical response. Furthermore, it is important to make the correct diagnosis in order to guide further investigations and management even if the initial treatment happens to be effective. Catheterization to sample the urine for urgent analysis should be considered in older patients who are acutely unwell.

References

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Received in revised form 2 August 1995