

**Original
Contributions****THE LACK OF ASSOCIATION BETWEEN AGE AND DIABETES AND
HOSPITALIZATION IN WOMEN WITH ACUTE PYELONEPHRITIS**

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□ Abstract—Background: Traditional management of acute pyelonephritis (APN) involves hospitalization and intravenous antibiotics. However, recently issued guidelines recommend that women with mild APN can be treated with oral antibiotics. **Objectives:** Many emergency practitioners feel compelled to admit all elderly and diabetic women with APN to the hospital. We explored the association between age and presence of diabetes with hospital admission in women with APN. **Methods:** A retrospective chart review was undertaken on women with a diagnosis of APN made in the Emergency Department between May 2003 and December 2005. **Exclusion criteria** were as follows: pregnancy, immune suppression other than diabetes, urinary stone, septic shock, and hydro-nephrosis. Standardized chart review was performed and the primary outcome was admission to the hospital. Univariate and multivariate analyses were used to identify factors associated with hospital admission. **Results:** Of the 388 patients included, 185 (47.7%) were admitted. After adjusting for confounding variables, the odds ratios of admission for those who had been recently hospitalized or had a low serum albumin level or a high C-reactive protein level were 2.10 (95% confidence interval [CI] 1.09–4.02), 1.96 (95% CI 1.09–6.05), and 2.57 (95% CI 1.11–3.46), respectively. Older age and the presence of diabetes were not found to be independently associated with admission. **Conclusions:** In women with acute pyelonephritis, an older age and diabetes were not found to be independently associated with hospital admission. © 2011 Elsevier Inc.

□ Keywords—acute pyelonephritis; diabetes; aged; admission; association

INTRODUCTION

Annually, an estimated 250,000 people in the United States are diagnosed with acute pyelonephritis (APN), and often require hospitalization (1). Traditional management of APN involves hospitalization and intravenous antimicrobial treatment. However, recently issued guidelines recommend that women with mild APN (low grade fever and a normal or slightly elevated peripheral leukocyte count without nausea or vomiting) who are compliant with therapy can be treated with oral antimicrobials on an outpatient basis (2). These guidelines also recommend that if a patient is sufficiently ill at the time of evaluation (high fever, high white blood cell [WBC] count, vomiting, dehydration, or evidence of sepsis), she should be admitted and treated with intravenous antimicrobials (2). Although it is clear that comorbid conditions also need to be taken into account when determining disposition, no strict guidelines have been issued regarding admission of the elderly or diabetic patient.

The purpose of the current study was to determine whether older age and presence of diabetes mellitus

were associated with higher hospital admission rates in women with acute pyelonephritis.

MATERIALS AND METHODS

Study Design

We performed a retrospective chart review to determine the association between patient characteristics and admission rates in women with acute pyelonephritis. The study was reviewed and approved by our Institutional Review Board and exempt from written informed consent.

Study Setting

The study was performed in a 950-bed urban academic hospital with an annual Emergency Department (ED) census of 55,000. The department is staffed by Emergency Medicine and rotating residents supervised by board-certified emergency physicians.

Study Subjects

Female patients 16 years of age or older presenting to the ED with a clinical diagnosis of acute pyelonephritis between May 2003 and December 2005 were eligible for enrollment. Of these patients, we included only those with pyuria (the presence of 10 or more leukocytes per high power field in the centrifuged specimen), fever (body temperature $> 38^{\circ}\text{C}$), and lumbar tenderness. We also included patients with only pyuria and lumbar tenderness if they had received an anti-pyretic medication within the last 4 h. Exclusion criteria included the following: pregnancy, nephrolithiasis, severe sepsis, septic shock, or severe hydronephrosis. Patients receiving immunosuppressant medications (such as systemic corticosteroids or chemotherapeutic agents) were also excluded.

Measures and Outcomes

Standardized extraction of demographic and clinical data from the electronic medical records was performed by trained data abstractors following the guidelines of Gilbert et al. (3). Clinical information abstracted included a history of recent hospitalization (during the previous month), recent use of antibiotics (during the previous month), diabetes mellitus, recurrent APN (defined as three episodes of documented APN over the previous 12 months), bedridden status, and other comorbidities (liver cirrhosis, cancer, chronic obstructive pulmonary disease,

and chronic renal failure). Older age was defined as over 65 years. Physical findings abstracted included initial blood pressure, heart rate (HR), respiration rate (RR), and body temperature (BT) in the ED. Continuous variables were dichotomized: systolic blood pressure (SBP) < 100 mm Hg and ≥ 100 mm Hg; HR ≤ 100 beats/min and > 100 beats/min; RR ≤ 20 breaths/min and > 20 breaths/min; and BT $< 39^{\circ}\text{C}$ and $\geq 39^{\circ}\text{C}$. Laboratory results were dichotomized as follows; hemoglobin level < 12 g/dL and ≥ 12 g/dL, WBC count $\leq 12,000/\mu\text{L}$ and $> 12,000/\mu\text{L}$, neutrophil % $< 90\%$ and $\geq 90\%$, C-reactive protein (CRP) < 10 mg/dL and ≥ 10 mg/dL, serum creatinine < 1.5 mg/dL and ≥ 1.5 mg/dL, and serum albumin < 3.3 g/dL and ≥ 3.3 g/dL. The main outcome measure was whether or not the patient was admitted to the hospital.

Data Analysis

Continuous data were summarized as means and standard deviations. Nominal data were summarized as percent frequency of occurrence. The association between predictor variables (patient demographics and clinical characteristics) and hospital admission was performed using univariate and multivariate methodologies. Univariate analyses were conducted using the chi-squared or Fisher's exact tests. Predictor variables that were associated with admission at a significance rate of > 0.10 were then entered into a logistic regression model to adjust for confounding variables. Adjusted odds ratios and associated 95% confidence intervals were determined using SPSS for Windows, version 13.0 (SPSS Inc., Chicago, IL).

RESULTS

During the study period, 388 female patients with APN were initially enrolled, and of these, 185 (47.7%) were admitted to the hospital. Their baseline demographic and clinical characteristics are summarized in [Tables 1 and 2](#).

CRP was checked in 64.9% (252/388) in total, and the test rate was not different between admitted and discharged patients (69.2% and 61.1%, respectively, $p = 0.095$). In case of albumin, 96.9% was checked in total, and there was no difference in the test rate between the two groups (96.8% vs. 97.0%, respectively, $p = 0.870$).

Based on unadjusted univariate analysis, admitted patients were older (> 65 years, odds ratio [OR] 3.33, 95% confidence interval [CI] 2.03–5.46), had been recently hospitalized (OR 2.65, 95% CI 1.30–3.29), had diabetes mellitus (OR 4.30, 95% CI 2.22–8.30), other notable disease (OR 4.21, 95% CI 2.30–7.72), a higher serum creatinine level (≥ 1.5 mg/dL, OR 3.48, 95% CI 1.51–7.99), an elevated CRP (≥ 10 mg/dL, OR 2.65, 95% CI

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