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Comparative Study of Urosepsis-Associated *Escherichia coli* in Tertiary Care University Hospital in the Central Region of Japan from 2008 to 2011

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Abstract

Escherichia coli infection is important cause of morbidity and mortality. Urosepsis is most commonly caused by *Escherichia coli*. It is generally reported to have low mortality rates and favorable outcomes compared with sepsis induced in other organ/system or tissues. This study was conducted to find out the clinical characteristics of urosepsis-associated *Escherichia coli* isolates at tertiary care university hospital in the central region of Japan from 2008 to 2011. *Escherichia coli* was identified by standard laboratory procedure. Antimicrobial susceptibility testing was performed by micro dilution assay according to CLSI recommendation. We analyzed the relationship between medical records appended to clinical species and bacterial data by using a statistical method. Of one hundred five *Escherichia coli*, fifty-three were from urosepsis and fifty-two were from other disease. The ratio of male to female from urosepsis tended to be lower than that from others. Forty-two isolates were from outpatient and sixty-three were from inpatient. The ratio of inpatient to outpatient from urosepsis was significant lower than that from others. With respect to age, the numbers of elder patients were higher than those of others. Most of the *Escherichia coli* isolates were from the emergency room followed by urology, and general medicine. The ratio of urosepsis to no urosepsis at urology department was significant higher than that at other departments. With respect to antimicrobial susceptible pattern, the ratio of urosepsis to no urosepsis about only aztreonam resistant was significant higher than that about other antibiotics. We need enough attention to be paid to urosepsis, especially female and elder patients.

Keywords

Escherichia coli, Urosepsis, Antimicrobial Resistance Susceptibility, Epidemiology

1. Introduction

Urosepsis is sepsis that derives from a urogenital tract infection [1]. In 20% - 30% of sepsis patients, the infection originates from the urinary tract, and urosepsis often develops from urinary tract infections (UTIs) acquired in a community or hospital [2]. About 5% - 7% of severe sepsis originates from UTI [3]. In previous study, the following are high-risk factors for urosepsis: Old age, female gender, diabetes, immunosuppression (organ transplantation), use of chemotherapy or steroids, AIDS, chronic renal failure, anemia, diameter of stone >2.5 cm and extremely long operation time [4]. Urosepsis is most commonly caused by *Escherichiacoli* [5].Two thirds of urosepsis caused *Escherichia coli* was extended spectrum beta-lactamase (ESBL) producers [6]. Although *Escherichia coli* induced urosepsis were predominant, little is known of the recent epidemiology of urosepsis associated *Escherichia coli* infection compared to others in Japan. The present study was conducted to find out the clinical characteristics of *Escherichia coli* isolates at tertiary care university hospital in the centre of Japan. Our result would be useful for contributing to larger more extensive surveillance study.

2. Materials and Methods

2.1. Strains and Clinical Data Collection

A total of one hundred five *Escherichia coli* were obtained from various clinical specimens at Nagoya City University hospital from 2008 to 2011. Nagoya City University hospital is an 808-bed tertiary care university hospital in the central region of Japan. We used medical records appended to clinical species for the analysis of clinical feature at Nagoya City University Hospital. We considered several isolates from the same region of the same patient as one isolate per one patient for the analysis in this study. All *Escherichia coli* isolates were identified by standard conventional biochemical methods or the VITEK2 system (bioMérieux, Durham NC, USA). Our experimental design was approved by the ethics committee at Nagoya City University.

2.2. Antimicrobial Susceptibility Analysis

Escherichia coli isolates were examined for 11 antibiotic susceptibilities as follow ABPC; ampicillin, PIPC; piperacillin, CEZ; cefazolin, CAZ; ceftazidime, CTX; cefotaxime, CFPM; cefepime, AZT; aztreonam, GM; gentamicin, MINO; minocycline, CPFX; ciprofloxacin, ST; trimethoprim-sulfamethoxazole. Minimal inhibitory concentration (MICs) were determined using broth micro dilution methodology with the VITEK2 system. Evaluation of antimicrobial resistance was based on Clinical Laboratory Standard Institute (CLSI) break point (M100-S20) [7].

2.3. Statistical Analysis of the Data

We conducted the statistical analysis with the chi-squared test or Fisher's exact test when appropriate. Differences were considered significant when p was <0.05.

3. Results

One hundred five *Escherichia coli* were isolated in this study. Of them, fifty-three were from urosepsis, and fifty-two were from other disease.

With regard to gender, the numbers of females from urosepsis tended to be higher than those from others (Table 1).

Table 1. Clinical characteristics between urosepsis and no urosepsis *Escherichia coli.*

	Urosepsis	No urosepsis	*p* value
Gender			
Male	15	24	0.058
Female	38	28	
Age			
0 - 10	0	1	0.382
11 - 20	0	1	0.382
21 - 30	0	0	1.000
31 - 40	0	4	0.121
41 - 50	0	1	0.382
51 - 60	7	7	0.970
61 - 70	8	7	0.811
71 - 80	18	18	0.944
81 - 90	17	11	0.206
91 - 100	3	2	0.983
Hospitalization			
Inpatient	26	37	0.021
Outpatient	27	15	
Department			
Emergency room	17	9	0.080
Urology	12	1	0.003
General medicine	9	4	0.251
Nephrology	3	3	0.692
Neurosurgery	2	1	0.987
Respiratology	2	4	0.657
Rheumatology	2	3	0.983
Cardiology	1	6	0.112
Endocrinology	1	0	0.992
Hematology	1	7	0.061
Neurology	1	2	0.987
Surgery	1	3	0.597
Gastroenterology	0	4	0.121
Otolaryngology	0	2	0.467
Orthopedics	0	1	0.382
Radiology	0	1	0.382

Forty-two isolates were from outpatient and sixty-three were from inpatient. The numbers of inpatients from no urosepsis were significant lower than those from urosepsis (p = 0.02) (Table 1). With respect to age, the numbers of elder patients were higher than those of others. However, there were significant differences of the patients between urosepsis and others (Table 1). Most of the *Escherichia coli* isolates were from the emergency room followed by urology, and general medicine. There were significant differences of the patients at urology department between urosepsis and others (p = 0.03) (Table 1).

Moreover, the results of antimicrobial resistant pattern of *Escherichia coli* isolates to various antibiotics tested in this study are shown in Table 2. We found the significant differences of aztreonam resistant pattern between urosepsis and others (p = 0.049).

4. Discussion

In this study, we described the characteristics of urosepsis-associated *Escherichia coli* isolates from 2008 to 2011 at tertiary care university hospital in the central region of Japan.

The ratio of male to female from urosepsis is lower than that from others. Other study also showed that the difference in gender distributions was due to the fact that females were more prone to urinary infections because anatomically urethra is short. [4]. Our study was consistent with this hypothesis.

The ratio of outpatients to inpatients from urosepsis is higher than that from others, because there are many opportunities for collecting sampling from an outpatient.

The prevalence of urology department is higher than others, because urology is a specialist dealing with urinary tract infection.

With respect to antibiotics resistant, the prevalence of aztreonam resistant was only higher than others in our study. As we did not find any significant differences of antimicrobial resistant pattern except aztreonam between urosepsis and others, our results

Table 2. Antimicrobial resistant pattern between urosepsis and no urosepsis *Escherichia coli*.

Antimicrobial resistant pattern	Urosepsis	No urosepsis	*p* value
ABPC	24	19	0.362
PIPC	21	14	0.168
CEZ	12	10	0.668
CAZ	9	3	0.134
CTX	9	4	0.251
CFPM	3	2	0.983
AZT	11	3	0.049
GM	6	8	0.540
MINO	8	9	0.758
CPFX	10	14	0.326
ST	14	9	0.259

suggest that we do not need to selectively use the antibiotic by diseasessuch as urosepsis. As geographical variation existed in the antibiotics resistance rates, the resistant rate of ampicillin/beta lactamase inhibitor, gentamicin and piperacillin/tazobactam + gentamicin was statistically significant in urosepsis [8]. In other study, resistance rates in urosepsis were higher than in other clinical diagnosis [8]. Our result suggested that aztreonam use might require careful administration with consideration of results of drug susceptibility.

In this study, we did not focus on postoperative status as a major consideration. In the previous study, the proportion of females (53%) was basically similar to other studies, but the proportion of postoperative patients was obviously increased [9]. It should be noted that, among hospital-acquired UTIs treated by urinary surgery, the mean incidence rate of urosepsis was 12%, but, in other fields, the incidence rates of severe sepsis and septic shock were 2% and 0.3%, respectively [10]. But our study did not show that there were significant differences of urosepsis incidence among departments of surgical system except urology. We need re-evaluate this point in further study.

Again, urosepsis is generally reported to have low mortality rates and favorable outcomes compared with sepsis induced in other organ/system or tissues. Rapid and appropriate management of sepsis, including the administration of an initially adequate intravenous antibacterial, is essential for optimal outcomes [11]. This should be considered by the use of suitable antibiotics in high-risk patients [5].

We need enough attention to be paid to urosepsis, especially female and elder patients. Further investigation about recent urosepsis situation in Japan will be desired.

Conflict of Interest

The authors declare that they have no conflict of interests.

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