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Original Article

Impact of urinary tract infection on nursing and healthcare-associated pneumonia☆

Masatoshi Yamazoe*, Hiromi Tomioka, Takamasa Wada

Department of Respiratory Medicine, Kobe City Medical Center West Hospital, Japan

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ABSTRACT

Nursing and healthcare-associated pneumonia (NHCAP), a concept of pneumonia proposed by the Japanese Respiratory Society, mostly occurs among elderly people in long-term care facilities. Similarly, the risk of urinary tract infection (UTI) also increases with age, with UTIs common among those in long-term care. Therefore, NHCAP is sometimes complicated by the presence of a UTI. However, pneumonia complicated by a UTI has not been clinically well characterized. We retrospectively analyzed 376 patients with NHCAP admitted to our hospital over a three-year period. Sixty-seven patients (17.8%) showed complications by a UTI. Patients with a UTI had lower renal function (higher blood urea nitrogen [$P = 0.001$], higher creatinine [$P = 0.001$]), lower systolic blood pressure ($P = 0.04$), higher A-DROP scores ($P = 0.005$) and higher positive blood culture rates ($P = 0.03$) than those without a UTI. Furthermore, based on urine, sputum and blood culture results, nearly half of the microorganisms (4/7) in blood cultures were identical with those of urine, suggesting that a concurrent UTI increases positive blood culture rates. Multivariate analysis showed that UTI was not an independent factor associated with 30-day mortality ($P = 0.17$), although patients with a UTI showed higher 30-day mortality ($P = 0.04$) than those without a UTI in univariate analysis. In summary, patients with NHCAP and a UTI were more prone to complications than those without a UTI, although UTI itself did not affect the prognosis of patients with NHCAP. A concurrent UTI had a negative impact on the severity of NHCAP.

1. Introduction

In 2011, the Japanese Respiratory Society (JRS) published therapeutic guidelines for pneumonia in the elderly, including nursing and healthcare-associated pneumonia (NHCAP) [1]. NHCAP is a variant of health care–associated pneumonia (HCAP) that relates to the Japanese population and that takes into consideration the national health care insurance system [1,2]. The definitions for both NHCAP and HCAP include hospitalization from long-term care facilities [1,2]. The risk of urinary tract infection (UTI) also increases with age, being a common infection among those in long-term care facilities [3,4]. For this reason, pneumonia, especially NHCAP, is sometimes complicated by UTI. The clinical characteristics of pneumonia together with UTI are, however, incompletely understood. Thus, the aim of this study was to elucidate the clinical significance of UTI in NHCAP.

2. Material and methods

We retrospectively analyzed consecutive patients with NHCAP who were admitted to Kobe City Medical Center West Hospital (a 358-bed community teaching hospital in Kobe City, Japan) between January 2015 and December 2017. NHCAP is a concept of pneumonia proposed by the JRS and is defined as any of the following: (1) pneumonia diagnosed in a person living in a nursing home or long-term care facility; (2) pneumonia diagnosed in a person within 90 days of the most recent hospital stay; (3) pneumonia diagnosed in an elderly or handicapped person who requires long-term care and has an Eastern Cooperative Oncology Group performance status of 3 or 4; or (4) pneumonia diagnosed in a person who is receiving regular outpatient endovascular treatment (e.g., dialysis, antibiotic therapy, chemotherapy, or immunosuppressant therapy) [2]. Patients transferred from other acute care hospitals

☆ All authors meet the ICMJE authorship criteria.

* Corresponding author. 4, 2-chome, Ichibancho, Nagata-ku, Kobe, 653-0013, Japan.
E-mail address: yamazoe@kuhp.kyoto-u.ac.jp (M. Yamazoe).

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were excluded. Pneumonia was defined as the presence of respiratory symptoms such as wet cough and increased sputum or the detection of the causative organism from the respiratory system, an increased white blood cell count or C-reactive protein (CRP) level, and the presence of a new infiltrate on chest imaging. Pyuria was defined as a leukocyte count ≥5 cells/high power field in a urine specimen that had been centrifuged [5–7]. Some urine cultures were obtained soon after finding pyuria, while the others were together with urinary sediment samples. Bacteriuria was defined as urinary pathogens at ≥ 100,000 colony-forming units (cfu) per milliliter [8]. UTI was defined as a condition showing both pyuria and bacteriuria [3,5]. The following cases were excluded: (1) cases for which a urinary sediment was not examined; and (2) cases that showed pyuria but for whom urinary culture examinations were not performed. The remaining cases were analyzed.

We divided the analyzed cases into two groups depending on the presence or absence of a UTI on admission: NHCAP with UTI (UTI group) and NHCAP without UTI (non-UTI group). We compared baseline demographic and clinical data, vital signs, laboratory data, A-DROP scores [9], bacteriological examinations, initial antibiotics and 30-day mortality rates between the two groups. Baseline demographic and clinical data included age, sex, underlying diseases, bladder catheter, home oxygen therapy (HOT), percutaneous endoscopic gastrostomy, postgastrectomy, and previous antibiotic treatment. Bacteriological examinations included urine, sputum, and blood cultures, pneumococcal urinary antigen tests (UATs) and legionella UATs. All data were obtained from clinical records. The A-DROP six-point scale (0–5), consisting of age (≥70 years in males or ≥ 75 years in females), dehydration (blood urea nitrogen ≥ 21 mg/dL or clinical signs of dehydration), respiratory failure (SpO_2 ≤ 90% or PaO_2 ≤ 60 mmHg), orientation disturbance, and low blood pressure (systolic blood pressure [SBP] ≤90 mmHg), was originally proposed as a scoring system for the severity of community-acquired pneumonia (CAP) by the JRS [9].

Blood cultures were obtained prior to antibiotic treatment and examined using a commercial blood culture system (BACTEC™ FX; BD, Franklin Lakes, NJ, USA). Pneumococcal and legionella UATs were performed using commercial kits (BinaxNOW; Alere Scarborough, Inc., Scarborough, ME, USA).

All statistical analyses were performed using JMP software package version 13.0 (SAS Institute Inc., Cary, NC, USA). Continuous variables were compared using unpaired *t*-tests and Mann–Whitney *U* tests. Categorical variables were compared using Chi-square and Fisher's exact tests. *P* values < 0.05 were considered significant. For univariate analysis of 30-day mortality, however, *P* values < 0.1 were considered significant. This study was approved by the Institutional Review Board of Kobe City Medical Center West Hospital with a waiver for informed consent because of its retrospective nature (approval number 18-022; approval date: January 31, 2019).

3. Results

Four hundred and fifty-eight patients with NHCAP were admitted to our hospital in a 3-year period from January 2015 to December 2017. Urinary sediment examination was performed in 403 patients, with pyuria observed in 132 patients. Of the 132 patients, urine cultures were obtained from 105. The cases that did not undergo urinary sediment examinations (n = 55), and those that showed pyuria but for whom urine culture examinations were not performed (n = 27), were excluded. As a result, 376 cases were included as analyzed cases (Fig. 1), consisting of 67 UTI and 309 non-UTI cases (Fig. 1). In other words, out of 105 cases with pyuria and urine culture examinations, 67 cases showed bacteriuria, that is to say, UTI. Microorganisms identified in urine cultures are shown in Table 1. *Escherichia coli* was the most commonly isolated microorganism, followed by *Enterococcus faecalis* and *Klebsiella pneumoniae*.

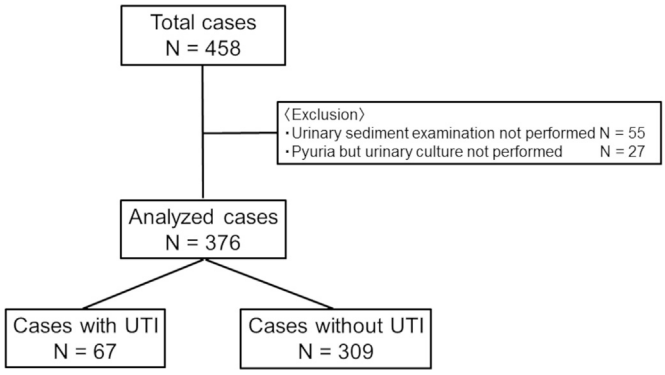

Fig. 1. Case selection chart. UTI, urinary tract infection.

A comparison of the characteristics of UTI and non-UTI groups is shown in Table 2. The UTI group showed a significantly higher mean age ($P = 0.005$), greater proportion of males ($P = 0.004$) and higher rates for bladder catheterization ($P = 0.01$) than the non-UTI group. The UTI group showed significantly higher proportions of cases with chronic kidney disease (CKD; $P = 0.02$), chronic heart failure (CHF; $P = 0.02$), and dementia ($P = 0.001$) as underlying diseases. In comparison, the UTI group had significantly lower rates of chronic obstructive pulmonary diseases (COPD; $P = 0.02$) and those receiving HOT ($P = 0.03$). The UTI group had a significantly lower mean SBP ($P = 0.04$) and pulse rate ($P = 0.03$), and significantly higher mean blood urea nitrogen (BUN; $P = 0.001$) and creatinine (Cr; $P = 0.001$) levels. The UTI group showed significantly higher A-DROP scores ($P = 0.005$), with older age ($P = 0.049$), and greater rates of dehydration ($P = 0.02$) and low blood pressure [SBP ≤90 mmHg; $P = 0.04$) in A-DROP parameters.

Blood cultures were taken from 354 patients: 64 UTI and 290 non-UTI patients. Of these, 18 blood samples grew bacteria of which 13 (UTI group: 7, non-UTI group: 6) were categorized as true positives. The UTI group showed a significantly higher rate of positive blood cultures ($P = 0.003$). Five cases were regarded as pseudo-positive and the precise exclusion process used was as follows [10,11]: (1) *Staphylococcus capitis* and *Corynebacterium amycolatum* (in one of two sets), (2) *Staphylococcus epidermidis* (in one of two sets), (3) *Staphylococcus caprae* (in one of two sets), (4) *Staphylococcus lugdunensis* (in one of two sets), (5) *Bacillus* species (in two sets) and methicillin-susceptible *Staphylococcus aureus* (MSSA; in one of two sets [however, the patient's sputum culture was negative]) were grown. Thirteen patients showed true positive blood cultures: MSSA (n = 3), methicillin-resistant *S. aureus* (MRSA; n = 1), *Streptococcus dysgalactiae* (n = 3), *E. coli* (n = 2), *E. coli and K.*

Table 1
Urine culture microorganisms.

Microorganism	n
Escherichia coli	37
Enterococcus faecalis	8
Klebsiella pneumoniae	5
Proteus mirabilis	4
Pseudomonas aeruginosa	4
Enterobacter cloacae	3
Streptococcus anginosus	3
Candida species	2
Citrobacter freundii	2
Corynebacterium striatum	2
Morganella morganii	2
Other	17

Table 2
Comparison of patients' characteristics between UTI and Non-UTI groups.

	UTI group (n = 67)	Non-UTI group (n = 309)	*P* value
Age, years	86.9 ± 7.4	82.9 ± 11.0	<0.05
Male gender (%)	43 (64.2)	137 (44.3)	<0.05
Bladder catheter (%)	9 (13.4)	14 (4.5)	<0.05
HOT (%)	2 (3.0)	36 (11.7)	<0.05
Percutaneous endoscopic gastrostomy (%)	9 (13.4)	27 (8.7)	0.24
Postgastrectomy (%)	2 (3.0)	19 (6.2)	0.39
Previous antibiotic treatment (%)	10 (14.9)	78 (25.5)	0.07
Underlying disease			
Asthma (%)	1 (1.5)	20 (6.5)	0.14
Cerebrovascular disease (%)	17 (25.4)	82 (26.5)	0.84
Chronic heart failure (%)	17 (25.4)	43 (13.9)	<0.05
Chronic kidney disease (%)	11 (16.4)	23 (7.4)	<0.05
COPD (%)	5 (7.5)	58 (18.8)	<0.05
Dementia (%)	53 (79.1)	179 (58.1)	<0.05
Diabetes mellitus (%)	16 (23.9)	47 (15.2)	0.09
Parkinson disease (%)	6 (9.0)	17 (5.5)	0.27
Body temperature, °C	37.8 ± 1.0	37.9 ± 1.1	0.42
SBP, mmHg	124.1 ± 30.1	132.4 ± 29.3	<0.05
Pulse,/min	95.3 ± 20.6	101.5 ± 21.9	<0.05
Laboratory data			
WBC,/μL	12043 ± 5734	11801 ± 5600	0.75
Hb, g/dL	11.5 ± 2.1	11.8 ± 1.9	0.28
Plt, × 10^4/μL	20.7 ± 8.8	22.2 ± 9.2	0.22
Total protein, g/dL	6.9 ± 0.9	7.1 ± 1.6	0.24
BUN, mg/dL	29.2 ± 20.7	22.5 ± 13.6	<0.05
Cr, mg/dL	1.1 ± 1.0	0.8 ± 0.5	<0.05
CRP, mg/dL	7.6 ± 7.1	8.5 ± 6.9	0.35
A-DROP score	2.6 ± 1.1	2.2 ± 1.1	<0.05
Age	65 (97.0)	276 (89.3)	<0.05
Dehydration (%)	42 (62.7)	147 (47.6)	<0.05
Respiratory failure (%)	39 (58.2)	178 (57.6)	0.93
Orientation disturbance (%)	21 (31.3)	67 (21.7)	0.09
Low blood pressure (%)	9 (13.4)	18 (5.8)	<0.05
Blood culture positive (%)	7 (10.9)	6 (2.1)	<0.05
	n = 64	n = 290	
Pneumococcal UAT positive (%)	4 (5.6)	13 (5.6)	0.50
	n = 47	n = 233	
Legionella UAT positive (%)	0	0	
	n = 47	n = 214	
30-day mortality (%)	12 (17.9)	29 (9.4)	<0.05

Data are presented as number (%) or mean ± standard deviation (SD) unless otherwise specified.
UTI: urinary tract infection. HOT: home oxygen therapy. COPD: chronic obstructive disease. SBP: systolic blood pressure. WBC: white blood cells. Hb: hemoglobin. Plt: platelets. BUN: blood urea nitrogen. Cr: creatinine. CRP: C-reactive protein. UAT: urinary antigen test.

pneumoniae (n = 1), *Streptococcus pneumoniae* (n = 1), *Streptococcus anginosus* (n = 1), and *Haemophilus influenzae* (n = 1).

Sputum culture microorganisms of UTI and non-UTI groups are shown in Table 3. In both groups, *S. aureus* was the most common, followed by *E. coli* and *K. pneumoniae*.

Furthermore, we investigated the relationship between microorganisms isolated from blood, urine and sputum samples. The microorganisms isolated from blood cultures derived from the UTI group were MSSA (n = 2), *E. coli* (n = 2), *E. coli* and *K. pneumoniae* (n = 1), *S. anginosus* (n = 1), and *H. influenzae* (n = 1). Out of these seven patients, identical microorganisms were grown in blood and urine cultures from four patients: *E. coli* (n = 2), *S. anginosus* (n = 1) and one patient whose blood culture was positive for *E. coli* and *K. pneumoniae* but who showed a positive urine culture result only for *E. coli*. In comparison, in the other three patients, blood culture microorganisms corresponded with those isolated from sputum but not urine cultures. The above-mentioned patient whose blood culture was positive for both *E. coli* and *K. pneumoniae* also showed positive sputum culture results for these two bacteria.

Pneumococcal UATs were performed in 47 UTI and 233 non-UTI cases, of which four UTI and 13 non-UTI cases showed positive results. Therefore, the two groups did not show a significant difference in pneumococcal UAT positive rates ($P = 0.50$). Legionella UATs were performed in 47 UTI and 214 non-UTI cases, but all cases yielded negative results.

The initial antibiotics used by UTI and non-UTI groups are shown in Table 4. Antibiotics were administered to all cases except one UTI case. In both groups, ampicillin/sulbactam were most

Table 3
Comparison of sputum culture microorganisms between UTI and Non-UTI groups.

	UTI (n = 57)	Non-UTI (n = 268)
Staphylococcus aureus		
MSSA	6 (10.5)	24 (9.0)
MRSA	5 (8.8)	13 (4.9)
Klebsiella pneumoniae	7 (12.3)	32 (11.9)
Escherichia coli	8 (14.0)	17 (6.3)
Pseudomonas aeruginosa	6 (10.5)	13 (4.9)
Haemophilus influenzae	2 (3.5)	16 (6.0)
Streptococcus pneumoniae	2 (3.5)	16 (6.0)
Moraxella catarrhalis	2 (3.5)	8 (3.0)
Enterobacter cloacae	0	9 (3.4)
Klebsiella oxytoca	1 (1.8)	5 (1.9)
Serratia marcescens	0	6 (2.2)
Candida species	0	5 (1.9)
Streptococcus agalactiae	2 (3.5)	2 (0.7)
Proteus mirabilis	2 (3.5)	1 (0.4)
Stenotrophomonas maltophilia	0	3 (1.1)
Other	2 (3.5)	11 (4.1)

Data are presented as a number (%).
UTI: urinary tract infection. MSSA: methicillin-susceptible *Staphylococcus aureus*. MRSA: methicillin-resistant *Staphylococcus aureus*.

Table 4
Comparison of initial antibiotics between UTI and Non-UTI groups.

	UTI (n = 67)	Non-UTI (n = 309)
ABPC/SBT	49 (73.1)	236 (76.4)
PIPC/TAZ	12 (17.9)	37 (12.0)
CTRX	4 (6.0)	26 (8.4)
AZM	9 (13.4)	2 (0.6)
CMZ	1 (1.5)	4 (1.3)
CFPM	4 (6.0)	0
Peramivir	3 (4.5)	0
CLDM	2 (3.0)	0
LVFX	2 (3.0)	0
ABPC	1 (1.5)	0
CAZ	1 (1.5)	0
VCM	0	1 (0.3)
MEPM	0	1 (0.3)

Data are presented as a number (%).
UTI: urinary tract infection. ABPC/SBT: ampicillin/sulbactam. PIPC/TAZ: piperacillin/tazobactam. CTRX: ceftriaxone. AZM: azithromycin. CMZ: cefmetazole. CFPM: cefepime. CLDM: clindamycin. LVFX: levofloxacin. CAZ: ceftazidime. VCM: vancomycin. MEPM: meropenem.

commonly administered, with 49 (73.1%) UTI and 236 (76.4%) non-UTI cases receiving these.

Twelve (17.9%) UTI and 29 (9.4%) non-UTI cases died within 30 days; therefore, the UTI group showed significantly worse outcomes than the non-UTI group ($P = 0.04$). We compared baseline demographic and clinical data, vital signs, laboratory data and A-DROP scores between 30-day survivors and non-survivors. In univariate analysis, 30-day survivors showed significantly higher rates of bladder catheter use, receiving previous antimicrobial treatments and CKD ($P = 0.09$, 0.03, 0.08, respectively), significantly higher BUN, Cr and CRP levels, and A-DROP scores ($P < 0.0001$, 0.002, 0.0003, <0.0001, respectively) and significantly lower body temperature, SBP and a hemoglobin level ($P = 0.01$, 0.06, 0.01, respectively). These ten parameters and UTI were included in a logistic regression analysis. Consequently, only the A-DROP score was identified as an independent factor associated with 30-day mortality (odds ratio [OR] 1.66; 95% confidence interval [CI] 1.16–2.43, $P = 0.01$), while UTI was not (OR 1.79; 95% CI 0.77–4.14, $P = 0.17$; Table 5).

4. Discussion

We retrospectively investigated 376 patients with NHCAP. Sixty-seven patients (17.8%) showed complications by a UTI. The UTI group showed a significantly greater mean age, and had a higher percentage of males. The UTI group also had significantly higher proportions of cases with CKD, CHF and dementia, and a lower proportion of cases showing COPD as underlying disease. In addition, the UTI group had significantly poorer renal function, lower SBP and higher A-DROP scores. Furthermore, significantly higher rates of positive blood cultures were characteristic of the UTI group. However, UTI was not an independent factor associated with 30-day mortality, although patients with a UTI showed higher 30-day mortality than those without a UTI.

Table 5
Logistic regression analysis of parameters associated with 30-day mortality.

	OR	95% CI	*P* value
UTI	1.79	0.77–4.14	0.17
Bladder catheter	1.57	0.49–5.01	0.45
Previous antibiotic treatment	1.91	0.91–4.04	0.09
Chronic kidney disease	1.11	0.34–3.69	0.86
Body temperature, °C	0.75	0.52–1.06	0.10
SBP, mmHg	1.00	0.99–1.02	0.64
Hb, g/dL	0.89	0.74–1.06	0.19
BUN, mg/dL	1.01	0.98–1.04	0.43
Cr, mg/dL	0.88	0.43–1.74	0.72
CRP, mg/dL	1.05	1.00–1.10	0.06
A-DROP score	1.66	1.16–2.43	0.01

OR: Odds ratio. CI: confidence interval. UTI: urinary tract infection. SBP: systolic blood pressure. Hb: hemoglobin. BUN: blood urea nitrogen. Cr: creatinine. CRP: C-reactive protein.

Definite diagnostic criteria for a UTI do not exist. In this study, pyuria was defined as a leukocyte count of ≥5 cells/high power field in a urine specimen that had been centrifuged [5–7]; bacteriuria was defined as urinary pathogens at ≥ 100,000 cfu per milliliter [8]; and UTI was defined as a condition showing both pyuria and bacteriuria [3,5]. The criterion for bacteriuria is highly specific to UTI and is widely accepted; sensitivity to UTI is reduced in young women with cystitis [12]. However, most of the study patients were of an advanced age (mean age of 86.3 years) and it can thus be said that such criteria for UTI were appropriate for this study population. For some diagnostic criteria relating to UTI, pyuria is not mandatory and only bacteriuria is required [4,13]. However, pyuria is sensitive for UTI, though not specific, and urinary sediment examinations are useful for excluding UTI [12]. Moreover, unlike urinary sediment examinations, the results of urine cultures are generally not available for several days. Therefore, considering the clinical usefulness of urinary sediment examinations, pyuria was included in the diagnostic criteria for UTI in this study.

The UTI group showed a significantly higher rate of CKD cases and overall showed significantly poorer renal function. Pertinently, UTIs have been linked to reduced renal function by others [14]. Thus, judging from the results of Xu et al. [14] and our study, poor kidney function should also be considered as a risk factor for UTI in pneumonia patients. The UTI group also showed a significantly greater number of CHF cases. One possible reason for this is that a significantly higher proportion of patients with CHF had CKD than those patients without CHF (21.7% vs. 6.7%, $P = 0.0002$).

The UTI group had a significantly higher mean age, and higher proportions of patients had undergone bladder catheterization and/or had dementia. Increased age and bladder catheterization are both well known risk factors for developing a UTI [3,15]. It follows then that UTIs are one of the common infections in long-term care facilities, whose residents frequently also have dementia [4,16].

With regard to COPD, its association with UTI is unknown. The reason why the UTI group had a significantly lower proportion of COPD cases as underlying disease is unclear in our study, with no reports of an association present in the literature.

Although UTI in males increases with old age, this has been generally observed to be more common among the female population than males as a whole [17]. In this study population, however, UTI was more common in males than in females. The underlying reason for this observation also remains unknown.

Positive blood cultures were observed at significantly higher rates in the UTI group. As mentioned above, out of seven UTI cases whose blood cultures were positive, bacteria isolated from blood cultures corresponded to those of urine and sputum in four cases. Therefore, approximately half of the microorganisms found in blood cultures are thought to have been derived from a UTI. Positive rates of blood culture examinations in UTI have been found to be 15.0–32.4% by others [18,19]. These positive rates were higher than reported rates in HCAP cases (4.6–9.0%) [20,21]. This suggests that concurrent UTI increases positive rates of blood culture examinations in pneumonia patients.

The UTI group showed a significantly lower mean SBP. Positive rates of blood culture examinations in the UTI group were only 10.9%; thus, the lower SBP in the UTI group cannot be explained by bacteremia. We analyzed cases examined by blood cultures (n = 354) and excluded those with bacteremia (n = 13). Even

without bacteremia, patients with UTI (n = 57) had a significantly lower SBP than those without UTI (n = 284; 125.2 ± 29.1 mmHg vs. 133.3 ± 29.2 mmHg [$P = 0.03$]). In Oka's study that examined patients with pneumonia aged >65 years, patients with UTI also had a lower SBP than those without UTI (119 mmHg vs. 128 mmHg), although this comparison was not significant ($P = 0.057$) [5]. These results suggest that a concurrent UTI may influence circulatory dynamics. Sepsis is defined as "life-threatening organ dysfunction caused by a dysregulated host response to infection", not requiring the presence of bacteremia [22], and urosepsis is defined as sepsis caused by an infection in the urogenital tract [23]. In urosepsis, complete bacteria and components of the bacterial cell wall from microorganisms originating in the urogenital tract trigger host inflammatory events, act as exogenous pyrogens on the eukaryotic target cells of patients, and often cause circulatory dysfunction [22,23]. Indeed, in our study, the UTI group had a higher proportion of cases with SBP ≤90 mmHg. However, we did not evaluate patients using sequential organ failure assessment (SOFA) scores or quick (q)SOFA scores, which are needed for a diagnosis of sepsis [22]. Therefore, we cannot conclude that the UTI group had sepsis more frequently than the non-UTI group.

The UTI group showed higher A-DROP scores and a 30-day mortality rate. The UTI group also had a significantly higher proportion of older patients, and more patients with increased dehydration, and low blood pressure with respect to its A-DROP parameters. Moreover, A-DROP score was an independent factor associated with 30-day mortality in multivariate analysis. Although evaluation of NHCAP severity using A-DROP score is not as useful as that of CAP and is only weakly recommended in the latest JRS guidelines [24], this study suggested that A-DROP score was useful for predicting prognosis in NHCAP. On the other hand, UTI was not an independent factor associated with 30-day mortality in multivariate analysis. This result is compatible with Oka's report. Oka et al. reported that UTI did not affect both the 90-day and 30-day mortality rates of patients who were admitted with pneumonia and treated with penicillin-based regimens [5].

Our study, however, has several limitations. First, not all patients who were admitted with NHCAP underwent urinary sediment and urine culture examinations. Some selection bias may have existed as a result. Second, patients with asymptomatic bacteriuria may have been inadvertently included since this is common in females and the elderly [3,4]. For such cases, antibiotics should not be administered [3,25,26]. However, a differential diagnosis of symptomatic UTI and asymptomatic bacteriuria in older adults, who are major populations with NHCAP, is challenging because of the difficulty in taking medical histories and conducting physical examinations due to their poor performance status and dementia [4,27]. Finally, since cases treated with antimicrobials just before admission were included, the detection sensitivity of infection, especially the detection of bacteriuria in non-severe cases, may have been reduced.

In summary, we investigated the clinical significance of UTI in NHCAP. CKD and dementia were identified as risk factors for developing a UTI, with concurrent UTIs linked to lower blood pressure and higher positive rates of blood cultures, and were not directly related to poor outcomes in patients with NHCAP. In future, a multicenter-prospective study is needed to validate study results.

Conflicts of interest

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