The aim of this study was to evaluate the risk factors for catheter related urinary tract infections (CR-UTI) caused by carbapenem resistant *Klebsiella pneumonia*. The rate of carbapenem resistant *K. pneumonia* isolates was progressively increased in our hospital in recent years. The aim of this study was to evaluate the risk factors for catheter related urinary tract infections (CR-UTI) caused by carbapenem resistant *Klebsiella pneumonia*.

### Background

Antimicrobial resistance is an emerging problem among nosocomial isolates. The rate of carbapenem resistant *Klebsiella* isolates was progressively increased in our hospital in recent years. The aim of this study was to evaluate the risk factors for catheter related urinary tract infections (CR-UTI) caused by carbapenem resistant *Klebsiella pneumonia*.

### Methods

In this study, CR-UTIs in a 650 bed tertiary care hospital between January 2014 and April 2017 were evaluated retrospectively. Data were obtained from inpatient charts and a computerized system for hospital infection surveillance.

All patients with nosocomial CR-UTI caused by *K. pneumonia* were included to the study. Only the first isolated *K. pneumonia* had recorded for each patient. Patients with urinary tract infection by carbapenem resistant *K. pneumonia* was defined as study group (CRKP), and carbapenem susceptible *K. pneumonia* as control group (CSKP). Nosocomial infection definitions were made by CDC criteria.

The identification and antibiotic susceptibilities of the isolates were determined by using VITEK II automated system (bioMérieux, France). Comorbidities and risk factors including invasive devices and procedures were compared between the two groups.

### Results

Among 122 patients with CR-UTI caused by *K. pneumonia*, 66 were female (54%), mean age was 69±20.2 years and mean hospital stay was 65.68 ± 54.56 days. Of patients, 113 were followed in intensive care unit (ICU) (93%). Mortality rate was 51% (62 patients) and 30 days mortality 66%.

Among all *K. pneumonia* isolates, CSKP was detected in 66 patients (54%) and CRKP in 56 patients (46%). Extended spectrum beta-lactamase (ESBL) rate was 81%. Colistin resistance was investigated in only 67 K. pneumonia isolates, it was 16.4%. In CRKP group, ESBL rate was higher than CSKP group and this difference was statistically significant (96% versus 68%) (p=0.000) (OR=12.6, 95% CI: 2.80-56.66). Colistin resistance was significantly higher in CRKP group than CSKP group (16.1% versus 3.0%, p=0.023) (OR=6.1, 95% CI: 1.26-29.68). When only the patients investigated for colistin resistance were evaluated, similarly, it was higher in CRKP group (32.1% versus 5.1%, p=0.006) (OR=8.7, 95% CI: 1.71-44.68).

In CRKP group, mortality rate was 3.19 times higher than CSKP group (p=0.002), but 30 days mortality was similar (p>0.05). Total length of stay in hospital was not different in the two groups (p>0.05) but length of stay in ICU (p=0.036) and length of stay before infection (p=0.049) was longer in CRKP group.

There was no significant difference in terms of comorbidities as chronic renal failure, diabetes mellitus, hypertension, cardiac failure, chronic obstructive pulmonary disease, coronary artery disease, malignancy, cerebrovascular disease, infection at admission and decubitus ulcer (p>0.05, for each).

In univariate analyses, when the risk factors including invasive devices and procedures were compared, having a central venous catheter (p=0.044, OR: 2.43 (1.09-5.88)) and parenteral nutrition (p=0.001, OR: 4.35 (1.83-10.31)) were risk factors for CRKP. In multivariate analyses, total parenteral nutrition was found independent risk factor for acquiring CRKP, p=0.001, OR: 4.88 (1.87-12.72).

### Conclusion

We detected that mortality rate was higher; length of stay in ICU and length of stay before infection were longer in patients with CR-UTI caused by CRKP than CSKP. The ESBL rate was also high in CRKP group. Total parenteral nutrition was found independent risk factor for acquiring CRKP.

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**Table 1: Comparison of demographic features, comorbidities and risk factors in patients with CR-UTI caused by CSKP and CRKP**

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>CSKP (n=66)</th>
<th>CRKP (n=56)</th>
<th>P</th>
<th>OR (95% CI min-max)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>70.6±16.92</td>
<td>67.20±23.43</td>
<td>0.367</td>
<td></td>
</tr>
<tr>
<td>Gender (M/F)</td>
<td>30/36</td>
<td>26/30</td>
<td>0.914</td>
<td>0.96 (0.47-1.96)</td>
</tr>
<tr>
<td>Mortality</td>
<td>25 (37.9)</td>
<td>37 (66.1)</td>
<td>0.002</td>
<td>3.19 (1.52-6.72)</td>
</tr>
<tr>
<td>30 days mortality</td>
<td>17 (68.0)</td>
<td>28 (61.9)</td>
<td>0.039</td>
<td>0.86 (0.29-2.55)</td>
</tr>
<tr>
<td>Hospitalization in ICU</td>
<td>61 (92.9)</td>
<td>52 (92.9)</td>
<td>0.997</td>
<td>0.94 (0.24-3.78)</td>
</tr>
<tr>
<td>Total length of stay in hospital (days)</td>
<td>59.23±53.51</td>
<td>73.29±55.27</td>
<td>0.157</td>
<td></td>
</tr>
<tr>
<td>Length of stay in ICU* (days)</td>
<td>41.64±34.40</td>
<td>61.08±57.51</td>
<td>0.036</td>
<td></td>
</tr>
<tr>
<td>Length of stay before infection (days)</td>
<td>28.14±24.46</td>
<td>38.84±37.68</td>
<td>0.049</td>
<td></td>
</tr>
</tbody>
</table>

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**Comorbidities**

- Chronic renal failure
- Diabetes mellitus
- Hypertension
- Congestive heart failure
- COPD**
- Coronary artery disease
- Cerebrovascular disease
- Infection in admission
- Decubitus ulcer

**Risk factors**

- Unconsciousness
- Endotracheal intubation
- Enteral nutrition
- Chest tube
- Hemodialysis
- Mechanical ventilation
- Nasogastric catheter
- Periferal artery catheter
- Periferal venous catheter
- Central venous catheter
- Parenteral nutrition
- Tracheostomy
- Transfusion
- Urinary catheter

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*K. pneumonia* - UTI caused by carbapenem susceptible *Klebsiella pneumonia* as control group (CSKP). Nosocomial infection definitions were made by CDC criteria. In CRKP group, mortality rate was 3.19 times higher than CSKP group (p=0.002), but 30 days mortality was similar (p>0.05). Total length of stay in hospital was not different in the two groups (p>0.05) but length of stay in ICU (p=0.036) and length of stay before infection (p=0.049) was longer in CRKP group. There was no significant difference in terms of comorbidities as chronic renal failure, diabetes mellitus, hypertension, cardiac failure, chronic obstructive pulmonary disease, coronary artery disease, malignancy, cerebrovascular disease, infection at admission and decubitus ulcer (p>0.05, for each). In univariate analyses, when the risk factors including invasive devices and procedures were compared, having a central venous catheter (p=0.044, OR: 2.43 (1.09-5.88)) and parenteral nutrition (p=0.001, OR: 4.35 (1.83-10.31)) were risk factors for CRKP. In multivariate analyses, total parenteral nutrition was found independent risk factor for acquiring CRKP, p=0.001, OR: 4.88 (1.87-12.72).