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Molecular investigation of *exoU* and *exoY* virulence genes in *Pseudomonas aeruginosa* collected from hospitalized patients in North of Iran: A descriptive–analytical study

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ABSTRACT

Objective: To investigate the frequency of *exoU* and *exoY* genes in patients with *Pseudomonas aeruginosa* infection.

Methods: In this study, 100 clinical isolates of *Pseudomonas aeruginosa* were collected from patients hospitalized in educational-therapeutic hospitals and were identified using standard microbiological tests. Then, the antibiotic resistance pattern of the isolates was determined by the disk agar diffusion method. The bacterial DNAs were extracted by the alkaline lysis method. Finally, the presence of *exoU* and *exoY* genes was evaluated by the PCR test.

Results: In this study, 47%, 72%, 29%, 39%, 40%, and 44% of the isolates were non-susceptible to piperacillin, aztreonam, ceftazidime, imipenem, tobramycin, and ciprofloxacin, respectively. In addition, 95% and 93% of the clinical isolates carried the *exoU* and *exoY* genes. Blood and fecal isolates had both virulence genes, while only one wound isolate had neither genes. Meanwhile, all urinary isolates contained the *exoY* gene and only one isolate lacked the *exoU* gene. Also, 88 isolates simultaneously had both *exoU* and *exoY* genes.

Conclusions: High prevalence of *exoU* and *exoY* genes in this region indicates a significant role of type III secretion system in pathogenesis of *Pseudomonas aeruginosa*. The type III secretion system may be a suitable target to reduce the pathogenicity of this bacterium.

KEYWORDS: *Pseudomonas aeruginosa*; *exoU*; *exoY*; Virulence gene; Type III secretion system; PCR

1. Introduction

Pseudomonas aeruginosa (*P. aeruginosa*) is an opportunistic multidrug-resistant (MDR) pathogen causing life-threatening infections in immunocompromised patients[1]. Growth of *P. aeruginosa* in diverse environments, such as hot tubs, humidifiers, soil, respirators, sinks, contaminated patients, and disinfectants, increases the prevalence of infections[2]. Due to the high intrinsic

Significance

Induction of cytotoxicity by the type III secretion system is an important pathogenicity strategy of *Pseudomonas aeruginosa*. ExoS, ExoU, ExoY, and ExoT can induce various forms of programmed death in host cells. This study showed that the high prevalence of ExoU and ExoY in this region can be a target for therapy or prevention of pathogenesis.

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This may be due to the exposure of bacteria under hostile hospital conditions. The lungs of infected patients, the skin of patients with burns, and the high consumption of antibiotics in medical centers can be irritants. It may be possible to reduce the pathogenicity of this organism by targeting the production of these exotoxins.

Conflict of interest statement

The authors report no conflict of interest.

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This study received no extramural funding.

Data availability statement

The data supporting the findings of this study are available from the corresponding authors upon request.

Authors' contributions

Conceptualization: HRG; Data curation: HRG, ARM, MG, NH; Formal analysis: ARM, MG, LD; Investigation: HRG, ARM, MG, NH, LD; Methodology: HRG, ARM, NH; Project administration: HRG; Software: HRG, MG; Supervision: HRG; Validation: HRG; Visualization: HRG, ARM, MG, LD; Writing and original draft: ARM; Writing, review, and editing: HRG, ARM, MG, LD, NH.

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