

PRELIMINARY COMMUNICATION / ПРЕТХОДНО САОПШТЕЊЕ

“Jack of all trades” spotted in the Clinical Centre of Vojvodina – first detection of *Aeromonas hydrophila* from urinary tract infection samples

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SUMMARY

Aeromonas hydrophila is representative of group within the *Aeromonadaceae* family that mainly causes infections in humans. Aeromonads can induce meningitis, septicemia, respiratory and hemolytic uremic syndrome as well as gastroenteritis. Regarding diverse mechanisms involved in virulence and metabolic adaptation of *Aeromonas hydrophila* to various hosts and environments it is often introduced as “Jack of all trades.” Here we report the first isolation of *Aeromonas hydrophila* from urine samples of three patients from the Urology Department within the Clinical Centre of Vojvodina. Epidemiological survey identified contact with surface water as the only mutual risk parameter. Following that, novel antibacterial agents against *Aeromonas hydrophila* are discussed.

Keywords: *A. hydrophila*; urinary infection; resistance; antimicrobials

Aeromonas hydrophila is detected in a broad variety of aquatic systems and it is regarded as an opportunistic pathogen. It is a Gram-negative bacterium and a representative of a group within *Aeromonadaceae* family that mainly cause infections in humans – motile aeromonads [1]. The presence of motile aeromonads was reported in a wide spectrum of food industry products (fish, meat, vegetables, milk, etc.), with predominance of *Aeromonas hydrophila* [2].

It is known that aeromonads have different virulence factors and can induce meningitis, septicemia, necrotizing fasciitis, respiratory and hemolytic uremic syndrome, and finally gastroenteritis in humans, where *Aeromonas hydrophila* was noted as the most common causative agent [1, 3–7]. Zhou et al. [8] reported that *Aeromonas hydrophila* induces extra-intestinal infections more often in patients with malignancy.

Food contamination is a mainly consequence of using water contaminated with *Aeromonas spp.*, as well as of overall poor hygiene in the working area during food processing or storage. It should be mentioned that milk is an exceptional medium for *Aeromonas hydrophila* growth, because of its nutrient composition, pH, and moisture content. Moreover, detection of *Aeromonas hydrophila* was reported in cheese, raw and pasteurized milk [2].

Since *Aeromonas hydrophila* has adopted diverse mechanisms involved in virulence and metabolic adaptation to various hosts and environments, it is often introduced as “Jack of all trades” [9]. Regarding the wide presence and

pathogenicity of *Aeromonas spp.* strains, extensive and protracted use of antibiotics in treatment and prevention finally resulted in evolution of antimicrobial resistant strains, mainly in aquatic microbial pathogen group [2, 5, 10, 11]. Furthermore, Daoood [12] reported a possible link between rising antibiotic resistance of aquatic strains and decreasing effect of antimicrobials in patients with *Aeromonas hydrophila* infections. Indeed, carbapenem-resistant *Aeromonas spp.* was reported recently in humans [13]. Besides that, *Aeromonas hydrophila* resistance to chlorine, low temperature, and the ability to form biofilm is described [14].

Here we report the first isolation of *Aeromonas hydrophila* from urine samples of three patients from the Urology Department within Clinical Centre of Vojvodina. Epidemiological survey was conducted in all three patients, where contact with surface water was identified as the only mutual risk parameter. All three samples were inoculated on blood agar, endo agar, and chromogenic agar, and were examined after an incubation period of 18–24 hours. Due to the atypical growth over the plates, Matrix Assisted Laser Desorption Ionization – Time of Flight mass spectrometry was used (MALDI Biotyper, Bruker, Billerica, MA, USA), where the presence of *Aeromonas hydrophila* was confirmed. Standard susceptibility to antimicrobials was determined via Kirby–Bauer test, known as the disc diffusion method; therefore, all three patients were treated with fluoroquinolones and reached remission.

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Considering the rising problem of multi-resistant *Aeromonas hydrophila*, several approaches have been recently suggested in order to outflank acquired bacterial resistance mechanisms.

Vijayakumar et al. [11] have demonstrated remarkable effect of fucoidan, marine brown seaweed extract, coated with gold nanoparticles. The tested substance showed larger inhibition zone compared to chloramphenicol (23.2 mm vs. 17.3 mm), as well as impressive biofilm inhibition activity against *Aeromonas hydrophila* [11]. Considering the treatment of aquatic organisms, as well as human patients, Rama Devi et al. [10] conducted an experiment with approach to target the quorum sensing system of *Aeromonas hydrophila* by introducing rosmarinic acid. They reported effect that includes significant inhibition of biofilm formation and production of virulence factors in three *Aeromonas hydrophila* isolates (AH 1, AH 12, and MTCC 1739) [10]. Stanković et al. [15] introduced millipede *Pachyiuli hungaricus* defensive secretion compounds as potential antimicrobial agents. Even lowest concentrations of isolated compounds (0.20–0.25 mg/ml) were reported as effective in *Aeromonas hydrophila* growth inhibition. They identified a total of 44 compounds, within which 2-methyl-1,4-benzoquinone and 2-methoxy-3-methyl-1,4-benzoquinone were most dominant. Antimicrobial activity of Serbian Propolis against *Aeromonas hydrophila* was demonstrated by Ristivojević et al. [16] by

a minimum inhibitory concentration assay, where zones of inhibition appeared at 0.05 mg/disc, while at a concentration of 0.20 mg/disc inhibition zone diameter was larger than 12 mm. Ramena et al. [17] tested antimicrobial activity of various plant extracts against *Aeromonas hydrophila*. In most cases, antimicrobial effect was insufficient compared to oxytetracycline, where only clove and cinnamon extracts showed inhibition zone diameter of 10.36 mm and 9.76 mm at a concentration of 50 mg.

In conclusion, considering effect of reported compounds against *Aeromonas hydrophila*, wide range of questions arise regarding compound isolation and stability, standardization and effectiveness in animal models respecting pharmacokinetics and pharmacodynamics parameters that will finally influence potential usefulness of novel agents. It should be noted that multi-resistant *Aeromonas hydrophila* strains are still not present in samples from Clinical Centre of Vojvodina, although the possibility for the emergence of resistant strains remains.

Ethical approval: All procedures described in this paper involving human participants were in accordance with the ethical standards and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Conflict of interest: None declared.

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„Мајстор свих заната“ детектован у Клиничком центру Војводине – прва изолација бактерије *Aeromonas hydrophila* из узорака уринарних инфекција

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САЖЕТАК

Aeromonas hydrophila је представник групе унутар фамилије *Aeromonadaceae*, која најчешће доводи до обољења људи, укључујући менингитис, септикемију, респираторни и хемолитички уремијски синдром, као и гастроентеритис, где се *Aeromonas hydrophila* сматра најчешћим узроковачем. Захваљујући различитим механизмима развоја вируленције и метаболичке адаптације наспрам различитих домаћина и утицаја спољашње средине, често се назива „мајстором

свих заната“. У овом раду извештавамо о првој изолацији бактерије *Aeromonas hydrophila* из узорака урина три болесника Клинике за урологију Клиничког центра Војводине. Епидемиолошком анкетом је контакт са површинским водама идентификован као једини заједнички фактор ризика. Остатак текста је посвећен прегледу нових приступа антимикробне терапије против бактерије *Aeromonas hydrophila*. **Кључне речи:** *Aeromonas hydrophila*; уринарне инфекције; резистенција; антибиотици