

Infection by *Raoultella ornithinolytica*: pathogenesis and clinical aspects.

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Abstract

The *Raoultella ornithinolytica* is a rare histamine producing bacteria in fish, leading to food poisoning after consumption. There are other pathogenic mechanisms disclosed in the literature. These lead to different clinical manifestations in humans such as sweating, diarrhea, vomiting, urinary tract infection and neurological involvements. Thus, there is an importance in obtaining the knowledge of infection caused by *R. ornithinolytica*, by health professionals. The aim of this study was to conduct a literature review regarding the etiology and pathogenesis of *Raoultella ornithinolytica*, and clinical manifestations caused as a result of their infection.

Introduction

The *Raoultella ornithinolytica* is encapsulated bacteria belonging to the Enterobacteriaceae family, classified as non-mobile aerobic gram-negative bacillus found in the aquatic environment 1,3 Moreover, it has the ability to maintain a temperature of 4 ° C. 4

The *R. ornithinolytica* has an exhaust system in addition to the pathogenesis mechanisms, the BLA gene. 1,3 Although there is a good response to treatment with broad-spectrum antibiotics such as Penicillin and Ciprofloxacin, it was shown that this gene is related to a resistance tool known as beta-lactamases, with fatal outcome in these cases. 3 Although few reports of human infection, *Raoultella ornithinolytica* is known for its conversion capacity of histidine in histamine in fish, causing poisoning after his consume. 3,4 It's also associated with infection by invasive procedures such as the implantation of orthopedic devices , intravenous catheters or intravascular prostheses. 6 Being found in specific cases of food or hospital infection this disease is considered rare.

It is a underestimated bacteria due to its reduced description in the literature, resulting in great ignorance on part of health professionals. 7 It was first described a case of sepsis in immunocompetent individual caused by *R. ornithinolytica*. 5 That is, the lack of knowledge can worsen the health status of a patient, causing him to death, in addition to increasing the risk of contamination in hospital equipment.

Material and Methods

This study consists of a review of specialized bibliographic literature. The papers were selected through search in PubMed and Medline database.

The search for articles was conducted between April and June of 2016. After reading the 25 abstracts initially selected by the descriptors, a new selection was made, and of those 25, 7 most relevant articles were separated. After the survey, followed by the analysis of the data, which were characterized by each knowledge area. The keywords used in the search were *Raoultella ornithinolytica*, scombroids, histamine and sepsis. The inclusion criteria for the studies found were the time of publication of the articles, the clinical approach, etiology and pathogenesis of the *Raoultella ornithinolytica* bacteria.

Results

The aim of this study was to present and discuss the most important findings about the pathogenesis and clinical aspects of the infection by the bacterium *Raoultella ornithinolytica*.

The pathogenicity and the toxicity of this bacterium have become increasingly relevant to the human disease. *R. ornithinolytica* is widely distributed in aquatic flora, fish, and insects. 3 It presents the following main mechanisms: adhesive capacity to tissues; conversion of histidine to histamine in scombroid fish; and biofilm formation in venous catheters.1,6

Clinical repercussions, reported in the analyzed articles, include gastrointestinal, urinary tract, respiratory system and skin infections. In addition, *R. ornithinolytica* is also related to nosocomial infections through invasive procedures, central nervous system infections, and bone and joint infections.2 Despite all that, the characteristics and clinical results on *Raoultella ornithinolytica* infection have not yet been fully elucidated in humans.

Discussion and Conclusion

The pathogenesis of *Raoultella ornithinolytica*, a gram-negative aerobic bacillus, is directly linked to the conversion mechanisms of histidine to histamine. The action of histamine occurs through the connection between epithelial, cardiovascular, respiratory, gastrointestinal and immunologic cell receptors. Histamine has psychoactive and vasoactive properties of very toxic and pharmacological characteristics, which presents a brief period of incubation and duration and can be evidenced by skin hyperemia such as in the diabetic foot.¹

When compared with other bacteria of the family Enterobacteriaceae, *Raoultella ornithinolytica* has similar capacity to adhere to human tissues. That explains its action in places like the gastrointestinal tract, for example.

Raoultella ornithinolytica also has the ability to form biofilms which are communities of bacteria enclosed by elements. Among these elements are the carbohydrates that are synthesized by the own bacteria. Biofilm protects the population of bacteria against various types of attacks that it may suffer, such as the lack of supplies, use of bactericides, and other attacks. Naturally, biofilm provides an ability of resistance in inanimate environments for *Raoultella ornithinolytica*.⁶

There is an imminent need for studies and researches that address infections by *Raoultella ornithinolytica* in human beings. Unfortunately, this is an underestimated issue since the bacterium is difficult to identify from the use of phenotypic methods. This bacterium represents a serious risk to health and should not be neglected.

References

- 1 SOLAK, Y.; GUL, E.E.; ATALAY, H.; GENÇ, N.; TONBUL, H.Z. A rare human infection of *Raoultella ornithinolytica* in a diabetic foot lesion. *Ann Saudi Med*, v. 31, n. 1, p. 93-4, 2011.
- 2 HARUKI, Y.; HAGIYA, H.; SAKUMA, A.; MURASE, T.; SUGIYAMA, T.; KONDO, S. Clinical characteristics of *Raoultella ornithinolytica* bacteremia: a case series and literature review. *J Infect Chemother*, v. 20, n. 9, p. 589-591, 2014.
- 3 MORAIS, V.P.; DAPORTA, M.T.; BAO, A.F.; CAMPELLO, M.G.; ANDRÉS, G.Q. Enteric fever-like syndrome caused by *Raoultella ornithinolytica* (*Klebsiella ornithinolytica*). *J Clin Microbiol*, v. 47, n. 3, p. 868-9, 2009.
- 4 FENG, C.; TEUBER, S.; GERSHWIN, M.E. Histamine (Scombroid) fish poisoning: a comprehensive review. *Clin Rev Allergy Immunol*, v. 50, n. 1, p. 64-9, 2016.
- 5 SUEIFAN, M.; MOOG, V.; RAU, E.; EICHENAUER, T. Sepsis durch *Raoultella ornithinolytica* bei einem immunkompetenten Patienten. *Der Anaesthesist*, v. 65, n. 2, p.129-133, 2016.
- 6 DJERIBI, R.; BOUCHLOUKH, W.; JOUENNE, T.; MENAA, B. Characterization of bacterial biofilms formed on urinary catheters. *Am J Infect Control*, v. 40, n. 9, p. 854-859, 2012.
- 7 KAYA, S.; BAYRAMOĞLU, G.; SÖNMEZ, M.; KÖKSAL, I. *Raoultella ornithinolytica* causing fatal

sepsis. *The Brazilian Journal of Infectious Diseases*, v. 19, n. 2, p. 230-231, 2015.