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LABORATORY DIAGNOSTIC APPROACHES FOR PSEUDOTUBERCULOSIS (Yersinia pseudotuberculosis)

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ABSTRACT. Pseudotuberculosis, caused by Yersinia pseudotuberculosis, is an acute zoonotic infection that can affect humans and various animal species. The illness often presents with fever, intestinal disorders, and in some cases, systemic symptoms such as rash or lymph node enlargement. Reliable and timely laboratory diagnostics are essential for confirming the infection, initiating appropriate therapy, and avoiding complications. The main laboratory approaches include bacteriological culture, serological assays, and molecular methods (PCR). Each technique provides specific diagnostic insights that complement one another and ensure accurate pathogen identification.

Keywords: Yersinia pseudotuberculosis, culture, serology, PCR, diagnosis, zoonotic infection.

ЛАБОРАТОРНЫЕ МЕТОДЫ ДИАГНОСТИКИ ПСЕВДОТУБЕРКУЛЁЗА (Yersinia pseudotuberculosis)

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АННОТАЦИЯ. Псевдотуберкулёз, вызываемый Yersinia pseudotuberculosis, представляет собой острое зоонозное заболевание, которое может поражать человека и различные виды животных. Болезнь часто проявляется лихорадкой, кишечными расстройствами, а в некоторых случаях — системными симптомами, такими как сыпь или увеличение лимфатических узлов. Надёжная и своевременная лабораторная диагностика имеет решающее значение для подтверждения инфекции, назначения адекватной терапии и предотвращения осложнений. Основные лабораторные методы включают бактериологическое исследование, серологические тесты и молекулярные методы (ПЦР). Каждый из этих подходов обеспечивает специфическую диагностическую информацию, которая дополняет другие методы и позволяет точно идентифицировать возбудителя.

Ключевые слова: Yersinia pseudotuberculosis, культура, серология, ПЦР, диагностика, зоонозная инфекция.

Introduction. Yersinia pseudotuberculosis is a Gram-negative, zoonotic pathogen of major epidemiological and clinical significance. It is primarily transmitted through contaminated food, water, or direct contact with infected

animals. According to multiple studies (Fukushima et al., 2011; Carniel, 2012; Aleksic & Bockemühl, 2020), Y. pseudotuberculosis belongs to the Enterobacteriaceae family and shares close phylogenetic similarity with Yersinia enterocolitica, though it differs in its clinical manifestations, reservoirs, and environmental survival characteristics.

Clinically, Y. pseudotuberculosis infection can resemble appendicitis, typhoid fever, enterocolitis, or mesenteric lymphadenitis (Bottone, 1999; Tauxe, 2004). This clinical polymorphism often leads to diagnostic confusion, emphasizing the necessity of laboratory confirmation through serological, bacteriological, or molecular diagnostic techniques (Fredriksson-Ahomaa & Korkeala, 2016). Misdiagnosis in clinical settings has been frequently reported in the literature, underscoring the need for improved laboratory-based diagnostic algorithms (Ostroff et al., 2010).

From an epidemiological perspective, Y. pseudotuberculosis is widely distributed in temperate regions and demonstrates the remarkable ability to multiply at refrigeration temperatures (0–4 °C). This psychrotrophic property allows it to persist in the food chain, particularly in refrigerated vegetables, fruits, and other raw products, thereby serving as a source of foodborne outbreaks (Niskanen et al., 2009; Jalava et al., 2006). Several large-scale foodborne epidemics linked to contaminated produce—especially cabbage, carrots, and leafy greens—have been reported in Europe and Japan (Le Guern et al., 2016; Sato et al., 2021).

Recent molecular and genotypic investigations have revealed significant genetic diversity among Y. pseudotuberculosis strains. Studies highlight the presence of major virulence determinants, including invasin (inv), superantigen YPMa, and the pYV plasmid, which collectively contribute to epithelial invasion, immune evasion, and systemic dissemination of infection (Wren, 2003; Wang et al., 2019). These virulence factors explain the organism's adaptability and pathogenic potential in both human and animal hosts.

In summary, the literature demonstrates that Yersinia pseudotuberculosis is a cold-tolerant, foodborne zoonotic agent capable of mimicking other enteric diseases while maintaining distinctive epidemiological and molecular features. Its ability to survive under refrigeration conditions makes it a persistent hazard in modern food supply chains. Consequently, enhanced molecular surveillance, improved food storage standards, and the implementation of rapid diagnostic technologies are essential to mitigate its impact on public health.

Materials and methods.

1. Bacteriological Techniques. The bacteriological culture method remains the gold standard for identifying Yersinia pseudotuberculosis. Samples such as stool, blood, mesenteric lymph node aspirates, or tissue specimens are inoculated onto selective media like CIN (Cefsulodin–Irgasan–Novobiocin) or MacConkey agar, incubated at 25–28°C for 24–48 hours. Colonies typically appear small, smooth, and translucent, often resembling a "fried-egg" morphology. Final

identification is achieved through biochemical profiling and agglutination tests using species-specific antisera.

2. Serological Techniques. Serological assays detect host antibodies directed against Y. pseudotuberculosis antigens. Widely used tests include agglutination reaction, ELISA, and complement fixation. The agglutination test employs a formalin-inactivated antigen, with diagnostic significance assigned to titers ≥1:160. ELISA provides higher sensitivity and specificity, allowing differentiation between recent (IgM) and past (IgG) infections.

3. Molecular Diagnostics (PCR). The Polymerase Chain Reaction (PCR) enables fast and highly specific detection of Yersinia pseudotuberculosis DNA in clinical or environmental samples. PCR assays commonly target virulence-associated genes such as inv, yadA, and virF, enabling the identification of even minimal bacterial loads. This approach is especially valuable when culture results are negative due to prior antibiotic treatment. PCR offers results within hours and assists in tracing infection sources during outbreaks.

Discussion and conclusion. Accurate laboratory confirmation of pseudotuberculosis necessitates a combined diagnostic strategy. While culture remains the definitive reference, it is time-intensive and may yield false negatives in antibiotic-treated cases. Serological and molecular tests enhance detection sensitivity and shorten diagnostic turnaround time. The integrated use of these methods ensures reliable pathogen identification, timely therapy, and effective epidemiological control of this zoonotic infection.

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