

The Role of D-Lactate in the Diagnosis of Periprosthetic Joint Infection

Zhizhuo Li¹, Chengxin Li¹ and Wei Sun^{*2}

¹Department of Orthopedics, Beijing, China

²Beijing Key Laboratory of Immune Inflammatory Disease, Beijing, China

***Corresponding author:** Wei Sun, Beijing Key Laboratory of Immune Inflammatory Disease, China-Japan Friendship Hospital, 2 Yinghuadong Road, Chaoyang District, Beijing 100029, China



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Abstract

Periprosthetic joint infection (PJI) is a catastrophic complication after arthroplasty. However, at present, there is still a lack of an accurate and efficient method for the diagnosis of PJI. In recent years, increasingly attention has been paid to the value of synovial fluid biomarkers in the diagnosis of PJI. In this article, we reviewed the current clinical studies related to synovial fluid D-lactate and analyzed the clinical value of D-lactate in the diagnosis of PJI.

Keywords: Periprosthetic Joint Infection; Biomarker; Synovial Fluid; D-lactate

Background

Periprosthetic joint infection (PJI) is a devastating complication after arthroplasty. Prompt establishment of an infection diagnosis is critical but can be very challenging at present [1]. Conventionally, the most used diagnosis methods for the diagnosis of PJI are peripheral blood tests, imaging examination, and microbiological examination. No single test is accurate enough for PJI diagnosis, and the test results must be combined with clinical history and symptoms. The diagnosis of PJI are limited in daily clinical practice due to their complexity [2]. A more specific and sensitive routine test for the diagnosis of PJI is badly needed. In recent years, increasingly attention has been paid to the value of synovial fluid biomarkers in the diagnosis of PJI [3]. At present, two studies [4,5] have reported that the synovial fluid D-lactate has high sensitivity and specificity in the diagnosis of PJI, and it is expected to become a new biomarker of synovial fluid.

The Biological Function of D-lactate

Lactate can be divided into D-lactate and L-lactate, which are isomers of each other. As the product of glucose metabolism, L-lactate is the main part of lactate in the human body. D-lactate is produced almost entirely by bacteria in the human body, which is a pathogen specific metabolite and can be detected in body fluids. Due to the lack of D-lactate dehydrogenase in tissue cells, D-lactate is metabolized slowly in the human body [6].

The Role of D-lactate in Bacterial Infection

As early as 1989, Smith et al. [7] analyzed 264 human fluid samples and found that D-lactate can be used as an infection marker to detect bacterial infections in various body cavities, such as thoracic cavity, abdominal cavity, and the sensitivity and specificity of D-lactate for the diagnosis of bacterial infections were 79.7% and 99.5%, respectively. The study of Korte kangas et al. [8] found that the concentration of D-lactate in the synovial fluid of patients with septic arthritis was significantly higher than that of patients with extraarticular infection.

The Role of D-lactate in PJI

Yermak et al. [4] analyzed 148 synovial fluid, including 44 from patients with PJI, and 104 from patients with aseptic loosening. The study found that the sensitivity and specificity of D-lactate for the diagnosis of PJI were 86.4% and 80.8%, respectively. Karbysheva et al. [5] analyzed 224 synovial fluid, including 71 from patients with PJI, and 153 from patients with aseptic loosening. The study found that the sensitivity and specificity of D-lactate for the diagnosis of PJI were 94.3% and 78.4%, respectively. Since D-lactate is a quantitative test, the authors further compared the accuracy of D-lactate in diagnosing PJI under different thresholds and determined that the best cut-off value of D-lactate was 1.3mmol/L.

Challenges and Future Considerations

D-lactate has important potential value for the diagnosis of PJI, and the advantage of high sensitivity makes this biomarker particularly suitable for the screening of PJI and is expected to be a new biomarker for the diagnosis of PJI. D-lactate also has deficiencies in the diagnosis of PJI. For example, the acquisition of synovial fluid is invasive and the diagnosis specificity is low. In the future, more research is needed to improve the accuracy of D-lactate in the diagnosis of PJI.

Author Contributions

All the authors potentially contributed to this manuscript.

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