Biomarkers for Imaging in Parasitic Diseases.

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Introduction

Parasitic diseases continue to pose significant public health challenges worldwide, especially in tropical and subtropical regions. Early diagnosis and accurate monitoring of these diseases are essential for effective treatment and control. Imaging techniques, enhanced by specific biomarkers, have emerged as powerful tools in the diagnosis, staging, and therapeutic monitoring of parasitic infections. Biomarkers for imaging offer targeted visualization of parasite presence, host immune response, or pathological changes induced by parasitic infections, providing critical insights beyond conventional diagnostic methods [1, 2, 3, 4].

The Role of Imaging in Parasitic Diseases

Imaging modalities such as ultrasound, computed tomography (CT), magnetic resonance imaging (MRI), and nuclear medicine techniques (e.g., positron emission tomography [PET] [5, 6, 7], single-photon emission computed tomography [SPECT]) are widely used to detect parasitic lesions, cysts, or tissue alterations. However, traditional imaging often lacks specificity, making it challenging to distinguish parasitic infections from other pathological conditions. Integration of biomarkers—molecules or signals indicative of infection or host response—into imaging improves specificity and sensitivity, facilitating better diagnosis and treatment planning.

Types of Biomarkers Used in Imaging

Biomarkers for imaging parasitic diseases can be broadly categorized as:

1. **Molecular Biomarkers:** These include parasite-specific antigens, enzymes, or nucleic acids that can be targeted by imaging probes (e.g., radiolabeled antibodies or ligands).
2. **Host Response Biomarkers:** Inflammatory markers, immune cells, or metabolic changes induced by infection can be visualized using specific imaging agents.
3. **Metabolic Biomarkers:** Parasites often alter local tissue metabolism, which can be detected using metabolic imaging probes [8, 9, 10].

Conclusion

Biomarkers for imaging in parasitic diseases represent a frontier that bridges molecular parasitology and clinical diagnostics. Their development enhances the ability to detect, characterize, and monitor parasitic infections with greater accuracy, facilitating improved patient management and advancing parasitic disease research. Continued innovation and validation of imaging biomarkers are essential to fully realize their potential in global health.

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